CHEMICAL LIBRARY

DEC 14 1920 UNIVERSITY OF MICHIGAN

GAS JOURNAL

LIGHT • HEAT • POWER • BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

Vol. CLII. No. 3003.] LONDON, DECEMBER 1, 1920. [72nd Year. Price 8d.

OXIDE OF IRON
SPENT OXIDE

GAS PURIFICATION AND CHEMICAL CO., Ltd.
PALMERSTON HOUSE, LONDON, E.C. 2.
Telegrams: "PURIFICATION, LONDON."
Telephone: 9144 London Wall.

PUMPING ENGINES
All Types for ACID, &c.
CAST-IRON OR STEEL TANKS
Any Capacity.
CHEMICAL PLANT.
Roofs and Girders. Structural Work.
SULPHATE OF AMMONIA PLANT
Air and Gas Compressors.
MIXERS.
TAR STILLS AND CONDENSERS.
W. NEILL & SON, Ld.
Engineers, Iron & Brass Founders,
ST. HELENS JUNCTION.
Telegrams: 'Neill, St. Helens.' Telephone No. 20.

PURIFYING MATERIAL
"Brownox-de-Luxe."
Unqualified Satisfaction given where used.
SPENT OXIDE PURCHASED
J. BROWN & CO., Ltd.
Savile Town, DEWSBURY.

TORBAY
JOINT STOPPING
FREE FROM LEAD.
The TORBAY PAINT CO.,
26/28, Billiter St., LONDON, E.C. 3.
39/41, Old Hall St., LIVERPOOL.

"BLUEBELL"
SILICA RETORTS
(95% SILICA)
John G. Stein & Co., Ltd.,
Castlecary, SCOTLAND.

Makers of
GASHOLDERS,
TANKS (C.I. or Steel),
PURIFIERS,
WASHERS,
ROOFS,
&c.
ASHMORE, BENSON, PEASE & CO., LTD.
STOCKTON-ON-TEES.
Complete GAS WORKS
London Office:
39, Victoria Street, Westminster, S.W.
Telegrams: "GASHOLDER."

W. & B. COWAN
(Incorporated in Parkinson and W. & B. Cowan, Ltd.),
LONDON. MANCHESTER. EDINBURGH. GLASGOW.
SYDNEY. MELBOURNE. BRISBANE. WELLINGTON, N.Z.
(See Advertisement on page III. of Wrapper.)

JAMES McKELVIE & CO.
Coal Owners,
Gas and Steam Coal Contractors,
17, RUTLAND SQUARE, EDINBURGH.
59, MARK LANE, LONDON, E.C.
GUILDHALL CHAMBERS, SANDHILL, NEWCASTLE-ON-TYNE.
24, CHAPEL STREET, LIVERPOOL.
ESTABLISHED 1840.

STEWARTS AND LLOYDS, Limited, 41, OSWALD STREET, GLASGOW. BROAD STREET CHAMBERS, BIRMINGHAM.
TUBES & FITTINGS for Gas, Steam, Water, &c.

ESTABLISHED — 1861 —
Telegrams: "DRY METERS, LONDON."
Telephone: KENSINGTON, 1140.

George Glover and Co., Ltd.
RANELAGH WORKS
Royal Avenue, Chelsea
LONDON, S.W., 3.

Highest Awards at the Principal International Exhibitions.
Branches at LEEDS (9, Dewsbury Road) and MANCHESTER (Gaythorn Meter Works, Easton St.).

SPECIALISTS IN DRY GAS METERS—SLOT, KEY, AND ORDINARY.
Every meter leaving George Glover and Co.'s works, irrespective of size—and they build up to 3000 Lights—is regulated and tested for soundness at 12 in. pressure, and for registration not only at the ½ in. pressure prescribed by the "Sales of Gas Act," but at 3 in. pressure with full outlet capacity, so as to prevent "slow" registration even when the meter is overworked.
AGENTS FOR THE PATENT M. & M. SELF-LOCKING SLOT METER PADLOCK.

"ELASTIC" PAINT
For ALL Gas Plant and Steel Structures.
Does not blister or "chalk" off.
GRIFFITHS BROS. & CO. (LONDON), LTD.
HERMONDSEY, LONDON, S.E. 16.

A GREAT BRITISH INDUSTRY

THE SECRET OF THE UNDOUBTED SUPERIORITY OF WELSBACH GAS MANTLES LIES IN THE FACT THAT FOR OVER 32 YEARS THE MOST EXPERT CHEMISTS HAVE CONCENTRATED ON THE VITAL POINTS WHICH GO TO COMBINE STRENGTH WITH BRILLIANCY

THE MATERIALS USED ARE THE FINEST QUALITY PROCURABLE AND CONSTANT CARE IS EXERCISED TO SEE THAT THE QUALITY IS NEVER ALLOWED TO GO BELOW THE HIGHEST STANDARD

WELSBACH
BRITISH MADE
GAS MANTLES

There are no better Mantles made

WELSBACH LIGHT

USE A SMALL BURNER WHERE A SMALL LIGHT WILL DO AND SO SAVE GAS

BRITISH MADE

THE IDEAL BURNER FOR SMALL ROOMS SUCH AS BATHROOM, SCULLERY, ETC., WHERE ONLY A SMALL LIGHT IS NECESSARY

THE

WELSBACH
ECONOMY BURNER

Prices and particulars upon application

ADVT. OF THE WELSBACH LIGHT CO., LD., WELSBACH HOUSE, KING'S CROSS, LONDON, W.C. 1.

DONKIN

A TIGHT GAS VALVE FOR HIGH-PRESSURE MAINS.

DOUBLE FACED GAS VALVES

(PATENT NO. 12784/06).

SPECIALLY SUITABLE FOR HIGH PRESSURE GAS.

We have specially designed these valves for use in connection with high-pressure gas, either with screwed ends, flanged ends, or with separate sockets for Mannesmann Steel Tube Rigid Joint. They have all the advantages of the rack and pinion or worm and rack valve—that is to say, they have the scraping action of the doors over the faces, as the two faces are separate and kept out to their work by springs, so that they will not have the disadvantage of the usual double faced solid body type valve which tends to jamb after it has been at work some time.

Very much thought and care have been given to the design of these valves and very rigid air tests have been made upon them for tightness.

PRICES ON APPLICATION.

This type of Valve has been adopted by the Birmingham Corporation and many other Works for their High-Pressure Mains.

LARGE NUMBERS SUPPLIED.

Head Offices & Works:

THE BRYAN DONKIN CO., LTD., CHESTERFIELD.

London Office: 3, VICTORIA STREET, WESTMINSTER, S.W. 1.

Chesterfield Telephone No. 84.
London Telephone No. 8368 Victoria.

Chesterfield Telegrams, "Donkin Chesterfield."
London Telegrams, "Donkin Vic. London."

CHESTERFIELD

GAS JOURNAL

LIGHT ✂ HEAT ✂ POWER ✂ BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON, E.C. 4.

VOL. CLII., No. 3003.] WEDNESDAY, DECEMBER 1, 1920. [72ND YEAR.

EDITORIAL NOTES.

The Endowment of the Livesey Chair.

A LEAD to a great opportunity has been given by Dr. Carpenter and his colleagues of the Board of the South Metropolitan Gas Company. They have intimated to the President of the Institution of Gas Engineers (Mr. Thomas Goulden) their willingness to subscribe £1000 to a fund for increasing the endowment of the Livesey Chair at Leeds University; and we learn from Mr. Charles Hunt, the Chairman of the South Suburban Gas Company, that his Board have voted £200 to the same laudable and pressing object. The gas industry generally will appreciate these timely acts of generosity, which, it is hoped, mark the inauguration of a special fund which will reach an amount so substantial that it will place the Department of Coal Gas and Fuel Industries now and for good beyond the region of penury. The lessons and the economic issues of the war are telling upon the Universities—Leeds among the rest. The country appreciates more to-day than ever that scientific training is essentially complementary to practical training and work; and the country knows better to-day than ever that scientific research is the highway of progress, prosperity, and protection. But the country is slow to recognize that the costs of living and of carrying on scientific training and research have advanced *pari passu* with all else that calls for expenditure of money. Money, too, for the Universities, as with everyone of us, has depreciated in value; and therefore on the old lines of income less work must be done if the Universities are—if the Department of Coal Gas and Fuel Industries at Leeds is—to continue in a solvent condition. More students are applying for admission. At Leeds University the number of students is two-and-a-half times more than in pre-war times. That is good. Many applicants have had to be turned away from its doors for lack of accommodation, and the funds necessary to provide it—particularly is this so in the laboratories devoted to scientific and technological work. That is bad.

To allow this state of things to continue would be a disgrace to the country; for the gas industry to permit the Department of Coal Gas and Fuel Industries to remain in a weakened position through changed circumstances, and so unable to put forth its maximum strength and utility, would be a reproach. It is the responsibility of the industry (whose whole operations, progress, and stability, are based more than ever upon scientific and technological work) to see that this does not continue to exist. It is eleven years since the proposal was carried into effect of endowing the Professorship of Gas Technology in memory of Sir George Livesey, whose labours for the industry supplied the road along which the development has been made that has brought to it the legislative changes which it is believed will promote in the best possible ways the work, services, and prosperity of the industry. No gas undertaking has done more in the prosecution of research within their own walls than the South Metropolitan Gas Company, the results of which research have been given freely to the industry. No gas undertaking knows better the cost of such research, and therefore the cost of carrying on the work that is done in the Department of Coal Gas and Fuel Industries at Leeds. Judgment is therefore based on experience and knowledge; and so when we read in the letter (published elsewhere in this issue) which Dr. Carpenter has sent to the President of the Institution, that the endowment was "never really sufficient for its purpose," we have no occasion to pause, with personal experience in every direction pressing confirmation upon us, in accepting the conclusion that what was insufficient before the war is lamentably short to-day.

Apart, however, from necessity, the time is remarkably opportune for making recognition and showing gratification. In no nobler manner could the industry commemorate the passing of the new gas legislation which means expansion for it, than by enabling the Coal Gas and Fuel Department at Leeds to increase its resources and power in its service. The industry will want from it all it can give, and in increasing quantity. Its efficiency is acknowledged. "To the granting of the new Charter which has been bestowed by "Parliament upon the gas industry," writes Dr. Carpenter, "the work at Leeds largely contributed." That is true. In this there is the proof of efficiency—proof that has been patent to all who have followed, and been in intimate touch with, the trend of events in the industry during the darkest period of its history, which happily has opened out into a brighter prospect, with an enlarged horizon. There is a debt of gratitude, which can be partially met by placing the department in the sound financial condition which it merits, and which the interests of the industry demand.

It will be remembered that at the last meeting of the Institution of Gas Engineers, Mr. Thomas Glover suggested that the time had come when the Council should consider the question of raising funds for increasing the endowment of the Department; and Prof. Smithells took the opportunity of intimating how welcome would be any increase of its resources. The practical lead which the South Metropolitan and South Suburban Companies have given in this direction will enable the Council of the Institution to decide as to the best steps to be taken to follow it up; and we know full well that it is the earnest hope of the President that the movement initiated by Dr. Carpenter and his co-Directors will receive the hearty support of the whole industry. We trust there will be an active and immediate response to the lead from all quarters of the industry, and that the fund will attain a total of worthy proportions. This will supply additional evidence of the satisfaction of the gas industry with the efforts of the Coal Gas and Fuel Department to do useful work for it. It will be a great encouragement, too, to the workers, and especially to Prof. Smithells and Prof. Cobb, whose devotion to the industry has been pronouncedly manifest through the past decade and more. The University is making an appeal for £500,000 for a Development Fund; but money subscribed by the gas industry through the Institution will be earmarked for the Coal Gas and Fuels Department.

Special Orders and Private Bills.

MARCHING orders have now been issued by the Board of Trade with respect to applications for Special Orders under section 10 of the Gas Regulation Act, which appear likely to become more popular than Private Acts, owing to the differences in the realization of new powers between simplicity and moderation on the one hand and cumbrous method and unknown expense on the other. We should imagine that, as soon as the new procedure and the powers obtainable through the Board of Trade under the liberally endowed section 10 get thoroughly appreciated in the gas industry, there will be considerable reluctance to have recourse to parliamentary application. There has been a perfect slump in this direction during the past six years through the war and the prevailing conditions. But, as our "Parliamentary Intelligence" last week and in the present issue shows, there promises to be in the coming session quite a respectable revival. Some of these notices foreshadow important work and interesting detail—in the latter respect certain changes necessitated by the transition that

is developing in the basis of operation and trading in the industry. The notices also indicate that a large amount of work is coming along in connection with gas undertakings which will claim the interest of plant manufacturers and contractors.

However, as already remarked, it is anticipated that the method of obtaining additional powers that will grow in popularity will be through the Board of Trade and Special Orders. In the statutory rules now issued (and published in other columns) for making applications for these, the procedure to be observed is stated. It is simple, and does not entail any very serious obligation. A great advantage over parliamentary procedure is that objections to draft Orders are to be lodged with the Board in writing within a specified time—a minimum of not less than thirty days is provided for—and the objections are to state specifically the grounds of objection, as well as the omissions, additions, and modifications asked for. The fee payable in connection with an application is only £35; but, of course, applicants must discharge in addition any extraordinary expenses incurred by the Board in respect of any inquiry into an application which they may deem it necessary to hold. Even so, the process will work out considerably cheaper than proceeding by way of Bill in Parliament with all the well-known avenues wide open for accumulating expense. We take it that where an inquiry is essential, this will be of the local order. If so, here again there should be economy; for many a small undertaking has felt very seriously the burden of expense incurred in connection with parliamentary procedure, when opposition has pursued it through the Committee rooms of both Houses. About the inquiries, section 10 of the Gas Regulation Act provides a large area within which expanding and financial powers can be obtained: New works powers, extension of gas-supply territory, amalgamations, joint working of undertakings, power gas supplies (authorization in regard to which are important in view of the activities of people with special processes for private gas making), and many other things. Promoters too will not overlook the recommendation of the National Gas Council that they should insert in their Private Bills or Special Orders a clause protecting them from the consequences of over-driving and incorrect registration of meters fixed by outside fitters, as also from the danger of high-pressure air-blast connections.

The scope and character of these matters lead up to another suggestion. We hope that, when inquiries are called for (the matters that will have to be dealt with being so largely of a technical nature), the Board will appoint competent technical gas men, with a knowledge of parliamentary procedure, to conduct them, and to report their conclusions to the Board. This would only be following the precedent supplied by the Electricity Commissioners—two or three of whom are trained and experienced electrical men; and in their hands inquiry and decision largely repose. These are new times; and reconstruction aims at doing things better than they were done before. We know of no retired army officers who are gas experts.

Neutralizing and Drying Sulphate of Ammonia.

THE members of the Southern Association of Gas Engineers and Managers devoted the greater part of their meeting on Tuesday of last week to the consideration of the processes of neutralizing and drying sulphate of ammonia; and a highly interesting and instructive discussion developed from the opening given to it by Mr. E. V. Evans, F.I.C., of the South Metropolitan Gas Company. Most gas men are agreed that neutralizing and drying sulphate of ammonia are correct and highly desirable; but at present comparatively few are doing it. After all that has been done to show the importance of this, after all the acknowledgment as to the technical and commercial value of carrying out the additional process, it caused a little astonishment to find the Chairman of the Sulphate of Ammonia Federation (Mr. D. Milne Watson) stating, at the meeting a few weeks since, that the production of a neutral quality sulphate now only amounts to about 30,000 tons per annum, which we make out to be merely 7½ p.ct. of the annual production in the United Kingdom. This does not indicate any great eagerness to put professions into practice. But perhaps, as there are various processes now available from which to select (as was heard during the discussion), the movement towards improving the salt by both neutralizing and drying—the one being as important as the other—will proceed at accelerated speed. As sellers, producers must comply with demand; as prudent men, they must look forward.

Throughout the discussion the speakers were in perfect accord as to the necessity for treatment to neutralize the acid and free the sulphate from moisture, and so improve its physical quality. Belief in the process came from the President (Mr. Charles F. Botley), Mr. W. M. Valon (who is practising it), Mr. Thomas Glover, Dr. R. Lessing, and Mr. P. Parrish. Mr. Glover made a little qualification. He does not see that it is essential to neutralize and dry the sulphate (provided it is of good quality) when supplied to manure makers for mixing with other ingredients for making fertilizers, though he admits that where the sulphate is going to be used by the farmers with drills or broadcasted, practice of the refining processes is desirable. The manure makers, however, form a comparatively small purchasing power; the greater home market is direct to the farmers themselves. And the farmers have their likes and dislikes, as well as wills of their own. They have a preference for the easy running neutral-dry sulphate; and when once used, they will not have the old type of stuff passed on to them, as Mr. Valon has learnt by an experience which he related during his contribution to the discussion. Now is the time to give the maximum satisfaction to the farmer; every day we are getting nearer the period when the stream of competition will commence to flow, and it will grow broader and deeper with time. This is not a vision which will possibly fade away; it is a fact. Synthetic ammonia (as Mr. Evans says) is quite neutral and practically free from moisture; and its mechanical properties, as well as its colour, are excellent. When buyers abroad begin to tell us plainly that our product, unneutralized and undried, is not so good as the German product, the time has arrived for making it at least equal, if not superior.

Therefore, it is hoped that the paper by Mr. Evans and the valuable discussion it evoked will be propagating media, and will have a substantial effect in bringing about the conversion of sulphate from its old state to the technically and the commercially approved and farmer-wanted new state. There are several methods of neutralizing and drying sulphate; and it will be for the sulphate maker who is desirous of sending out salt as good as the best for carriage and application to use his selective faculties in determining which form of plant or process he should adopt. Mr. Evans was quite explicit and very frank. Naturally he believes in the South Metropolitan process for performing the dual operations of neutralizing and drying. But he refrains (as a chemist he knows the value of being cautious in this respect) from labelling it "*Ne plus ultra*." He also refers to the several other workers in the same field—viz., Adam, Capron, Linder, Lessing, and Sheard, to which names Valon may be appended. The workers have been operating downwards. The first plants that were developed were high in installation and working costs. But there has been progressive simplification, and with simplification economy. The neutralizing process worked by Mr. Valon is the same as that of the South Metropolitan Company, in the development of which he was interested; but the system he has adopted for drying is a plan which he finds quite suitable and less costly for works of the size of those at Stafford. In Dr. Lessing's system, neutralization can be done in the same apparatus in which the salt is dried. Briefly stated, the South Metropolitan process provides for neutralizing the sulphate by means of condensing the vapours from the fixed ammonia still, diluting the solution of ammonia thus obtained until its strength is such that it loses practically no ammonia at the temperature at which it is used, and then washing the crystals of sulphate of ammonia in a centrifugal machine at 75° C. The condensing system, the procedure of neutralizing, and the drying process are all described in detail in the paper.

The costs of the processes are given by Mr. Evans as 4d. per ton for neutralizing, and for drying, 1s. 3d. In an aside, he spoke of 9d. to 1s. The President referred to the fact that the treatment could be applied for 9d. to 1s. 3d. per ton as astonishing him; and Mr. Valon said their costs at Stafford averaged just under 9d. per ton. It is clear that the differences in working conditions have an effect on the expense; but Mr. Parrish demonstrated that economically the process pays, quite apart from the commercial necessity for neutralizing and drying. Mr. Valon also states that, making an allowance for the loss of weight in producing 25½ p.ct. sulphate, they are receiving 9s. extra profit per ton. However, it would be useful to have from

the various operators of neutralizing and drying processes definite particulars as to their costs, under stated circumstances. As to installation costs, there is Mr. Valon's authority for stating that the plant at Stafford for dealing with a make of from 400 to 600 tons would cost between £500 and £550; and for each extra 200 tons, £50 should be added to the cost.

There were several other matters dealt with in the discussion—the colour of sulphate being one of them. Upon this aspect of the matter, Dr. Lessing dilated; and there is agreement with him that a perfectly white sulphate is more attractive than a discoloured material, and will the better compete with the synthetic product. He also commented upon the extraction of pyridine. These are all matters affecting the quality of sulphate that coming competition will demand shall receive attention; and the refinements effected in physical quality will greatly strengthen the future trading position of the British production.

Direct Recovery of Sulphate.

IT was an admirable, if modest, paper that Mr. Alec. G. Cheal submitted at the meeting of the Southern Association of Gas Engineers and Managers, on the direct recovery of sulphate of ammonia. Since the last report of the Chief Inspector under the Alkali Works Regulation Act, this process for gas-works purposes has been under a cloud; but Mr. Cheal's paper should help to dissipate this. He has had experience of the process at two works—at one of which, Crowborough, the experience has been unsatisfactory, and at the other, Edenbridge, it has been the contrary. At the latter works, the average production of sulphate of ammonia over five years was 21·6 lbs. per ton of coal carbonized, which is not bad for a small works. It is clear from the comparisons that Mr. Cheal is able to institute that the conditions under which the plants work (not the plants themselves), are responsible for satisfactory or unsatisfactory working. Efficient condensation of the gas before entering the acid washer is a point which has an important bearing on the yield. Where there is inefficient condensation, the tar-fog produces mischief in preventing active absorption of the ammonia. Another simple but important matter is the necessity for continuous circulation of the mother liquor so as to obviate its stratification in the acid washer. Other hints are given in the paper as to the methods to secure efficient working; but it is obvious that the direct system demands a good deal of supervision. The salt is of good character, testing 25·16 p.ct. ammonia from Edenbridge, no free acid, and 2·2 p.ct. moisture. In the discussion, as will be seen, Dr. Lessing confirmed Mr. Cheal's deductions from his experience; and Mr. P. Parrish believes it should be possible to recover more than the quantity of sulphate named, providing certain modifications are made, which will be found detailed in his speech.

Passing of the Jet Photometer—The "Caloriscope."

ONE of the minor changes in the coming of the heat-unit basis of working and charge will be the departure of the jet photometer, and the installation of a substitute—when a suitable one is (if not already) found, and is generally approved. The old jet photometer has been a much abused servant; but it has had universal acceptance, because nothing better was ever devised that would at a glance show retort-house foremen, exhauster attendants, or all others concerned whether or not the make of gas was being kept up to the mark. The jet photometer has now to resign its place; and the South Metropolitan Gas Company, in the van of the movement to a new order of things, have been experimenting in the effort to find a substitute, which shall act as guardian on the works, as distinct from the laboratory, over the calorific power of the gas being manufactured.

The Company's experts have designed an instrument, which they have named the "Caloriscope." The first production was exhibited at the meeting of the Southern Association of Gas Engineers and Managers last week, by Mr. E. V. Evans, F.I.C. Even though the instrument may not, and does not we have the authority of Mr. Evans for saying, represent finality in design, the Company and their research officers must be complimented upon the success so far achieved, which success is confirmed by the fact that, over a considerable range of gases, the calorific determinations only varied from those found by the Boys calorimeter by no more than 2 p.ct. This is sufficient to show that the investigators and designers have secured an achievement upon which they can be complimented, and which justifies them in working still further along the adopted path for more improvement, which must be of the order of simplification. This means experience and additional research. The designing of an indicator for calorific determinations is obviously not such an easy matter as was the designing of a jet photometer. Already the new instrument (which is described and illustrated in this issue) has undergone some modification in the direction of simplification; and Mr. Evans gives us his opinion that the final design will be a very simple thing indeed. This is satisfactory, because, looking at the photograph, and reading the explanation of the principle and considerations embodied in the instrument, it can be imagined that, if not to the trained gas official, to the retort-house foremen, exhauster attendants, and others whose duties will claim an interest in, and use of, the substitute for the jet photometer, the new comer will suggest complication and scientific attributes to which they are not accustomed; and therefore they will not regard it over-friendlily. When, however, they are shown that calorific determinations can be accomplished in thirty seconds, they will be more willing to make closer acquaintance.

The principle upon which the new instrument is based was discovered by Mr. E. J. Brady, of Philadelphia, whose work in this direction was described in the "JOURNAL" for Dec. 16, 1919 [p. 608]. It has been known for a long time that the ratio of primary air to gases such as are supplied for town use varies with the calorific power of the gas. This applies over a considerable range of gases, although the relationship probably does not exist with all combustible gases. Thus it is that one gets a somewhat close equality in B.Th.U. per volume of gas-air mixture at the point of combustion. What Mr. Brady found was (as expressed by Mr. Evans) that, when air is admitted in gradually increasing proportion to a luminous gas-flame, or gas is added to a non-luminous bunsen flame, a point is reached when the luminous tip in the interior of the flame just disappears. At this point, the primary air bears a linear relationship to the calorific value of the gas. Where Mr. Brady failed to apply this knowledge to a gas calorific value indicator, the South Metropolitan Company's technical staff succeeded. However, the relationship between the primary air and the gas supplies the basic principle of the new instrument. Changes in specific gravity were a difficulty; but in the instrument any alteration in the density of the gas is automatically corrected by a change in the inducing power of the gas. A bunsen burner is provided with a good governor on the gas supply, and a throttle in the form of a sensitive needle-valve on the air-inlet. The operation of the throttle causes the movement of a pointer over a scale graduated in B.Th.U. Other and the fuller details must be obtained from Mr. Evans's explanation. This all shows that good work is proceeding in the provision of those accessories to work which the change in the basis of the operations of the gas industry necessitates.

Gas Company Returns for 1919.

THE Board of Trade returns relating to gas undertakings come back to us like old friends who have been distantly absent for a long spell; and throughout the gas industry they will be welcomed with, of course, regret that their continuity, through the stress of circumstances, had to be broken. As yet we are only allowed to pick up the thread of things again by the statistics relating to statutory gas companies for the year 1919; the companion figures for local authorities not yet being available. However, there is much of interest attaching to the statistics. They tell a tale of progress, despite every condition of working and trading offering resistance. They show, too, how closely the statutory gas companies have worked in the additional price they have taken from their consumers, how gas consumption has not gone up abnormally through the distribution of a gas of lower calorific quality per cubic foot, and how a supposed suicidal policy has not yet commenced to wreck the industry. Nothing of the kind is reflected in the official data now before us. The total receipts of the statutory gas companies rose from £22,814,641 in 1914 to £43,037,484 in 1919—an advance of £20,222,843. Expenditure called for that increase and something more; for the total spendings on revenue account advanced from £18,556,692 to £39,134,309—an increase of £20,577,617. Thus it will be seen that the increase of expenditure was

£354,774 over the increase of receipts. This shows that the gas companies were not grasping. It also indicates that the consumers would have had to pay somewhat more had it not been for the injustice done to the capital employed in their service. They have been beneficiaries from an injustice.

Between 1914 and 1919, the number of customers of the companies was augmented by 167,903—from 4,342,692 to 4,510,595. The total quantity of gas sold in 1919 was 145,880,443,000 c.ft.—an increase of 13,041,324,000 c.ft. upon 1914, or 9·81 p.ct. This does not suggest that the consumers have had to burn a considerable quantity of gas in excess of 1914, on account of the reduction of the calorific value per cubic foot. On the contrary, it shows progress of anything but an abnormal character. The quantity of gas made in 1919 was 160,826,784,000 c.ft., the components of which quantity were: Coal gas, 127,615,929,000 c.ft.; water gas, 28,723,808,000 c.ft.; and "other gas," 4,487,047,000 c.ft. The increase upon 1914 of the total gas made was 14,979,374,000 c.ft. Compared with 1914, an additional 10,988,956,000 c.ft. of coal gas were made, and 4,955,983,000 c.ft. of water gas; but of "other gas," 965,565,000 c.ft. less were produced. Supplementing the total gas made on the works, 463,285,700 c.ft. were purchased in bulk. This figure will in future exhibit a considerable difference when the local authorities' returns for coke-oven gas come to be added. The total quantity of coal carbonized last year by the statutory companies was 10,596,697 tons—an increase of only 760,432 tons, or 7·73 p.ct., on 1914, while, as previously shown, the sales of gas have risen by 9·81 p.ct. These figures indicate a good contribution by gas companies to coal conservation, seeing that 10,988,956,000 c.ft. extra coal gas was made with an expenditure of coal only greater by 760,432 tons, and an additional 4,955,983,000 c.ft. of water gas was produced, supplemented by 463,285,700 c.ft. of gas bought in bulk. The gas made per ton last year averaged 12,043 c.ft., which is an improvement of 187 c.ft. The average conceals all differences in coal and manufacturing conditions. Had the make remained at the level per ton of 1914—11,856 c.ft.—the 10,596,697 tons would have yielded 1,981,582,339 c.ft. less. Of course, the average increase of gas made per ton would have been much better had the coal not been degraded by higher percentages of inerts.

Taking this disadvantage into consideration, the figures attest the technical advance made by the industry in its manufacturing operations, which advance will be progressively accentuated. It has been made without injury to the consumers in respect of quality; for, though the calorific power per cubic foot has been reduced, the gas has evidently been used to better purpose. The consumers have had to pay more for the gas; but in its provision the industry has spent more than the extra amount received from the consumers. The dividends paid upon the capital employed are the deplorable aspect of the returns; but fortunately the remedy is at hand.

New Testing Regulations for Meters.

On inquiry, we learn from Mr. P. A. MacMahon, the Deputy Warden of the Standards, that the regulations to be made by the Board of Trade, pursuant to section 12 of the Gas Regulation Act, in relation to instruments for measuring gas, have not yet been approved. The date at which the regulations will come into force will not be Jan. 1 next, but probably March 1.

Favourable Coal Output.

It is stated that in the coal areas output is increasing favourably. The miners' representatives are anxious for a higher production, as they recognize that improved wages must now depend largely upon the quantity of coal that is available for export. It is stated that the output for the week ending Nov. 20 was upwards of 5 million tons, which is the best figure for this year. Where there is the will, there is a way.

The Hot-Plate and Higher Efficiency.

The effect of burners and bars upon hot-plate efficiency was the subject dealt with in a paper by Mr. F. S. Larkin, of the Gas Light and Coke Company, at a meeting last Friday of the London and Southern Junior Association. At first blush, this may seem a small matter; but, whether treated in an elementary or a scientific fashion, its importance is to be measured by the gas wasted by existing hot-plate structures, which waste is the scope for saving. When one considers that something like 75 p.ct. of the work a cooker with hot-plate has to perform is done on the latter, and 15 to 25 p.ct. of the heat of the gas used on the hot-plate is wasted owing to past faulty design, then the matter assumes somewhat gigantic proportions, having regard to the extent that old pattern cookers are in existence. The design of some of the old forms of hot-plates has given the gas consumers of the country a serious heritage, which, however, they appear to tolerate with perfect equanimity, owing to the compensating convenience. But scientific work has stepped in; and a change has come about in design which, giving higher efficiency, accentuates the mistakes of the past. Systematic correction would be expensive; but correction should be the policy as stoves are brought in for repair or cleaning, so as to produce a gradual elimination.

Burners and Bars.

There are boiling-rings, for instance, in existence with the jets in such position that they impinge only on the peripheries of the most-used vessels placed over them, instead of coming in contact with the central part of the bottoms of the vessels. In some cases, their situation is such that contact of the jets with the bottoms of the vessels is almost an impossibility. The supporting bars over the burners are great sinners. They intersect jets, spoil their free burning and shape, and act as conductors of heat away from the useful point of application. In such circumstances, the best possible efficiency cannot be attained. Mr. Larkin calls attention to all these things, and proves their wastefulness. The newer forms of top plate have no bars over the jets, but circular openings which allow free burning and full contact, and prevent a large amount of waste by conduction. But where they are over the burners the form and weight of the bars themselves have an important bearing on the question of waste. This is one of the best points made by Mr. Larkin. In one form of bar, he finds the loss of the potential heat is as high as 35 p.ct. The width, the depth, and the pitch of bars where these must be continued on existing apparatus should receive attention. The smaller the bar section consistent with sufficient strength, the smaller the loss of heat by conduction. It is an obvious error to have to heat-up metal as well as the contents of the vessel above. Mr. Larkin finds with twelve types of bars that the weight of metal beneath a 7½-in. diameter pot varies from 0·95 lb. to 2·01 lbs. If less than 1 lb. is sufficient, then why have over 2 lbs.—wasting metal, adding to cost, and sacrificing the heat of the gas? Under a 9-in. pot, the weight of metal varied from 1·36 lbs. to 2·98 lbs. Two other points. Mr. Larkin calls attention to the absurdity of some experimenters showing high efficiencies by using net values of gas, instead of gross. Now that gas is to be sold on the gross value, it is better that efficiencies should always be quoted on gross calorific values. He also pleads for the development of a standard test for cookers, and looks to the "B.C.G.A." to formulate such a test.

Trade Policy.

The Government are being pressed on all hands to set about the task of defining and prosecuting a trade policy which will be of real benefit to the country. The industries cannot possibly for a long time to come, unaided by the Government, get out of the terrible mess into which industrial affairs have fallen; but naturally the Government must have advice from industry. The other day the British Commonwealth Union Industrial Group in the House of Commons, with representatives of industry, had an interview with Sir Robert Horne. Our old friend Sir Hallewell Rogers presided on the occasion; the conference being composed of 53 Members of Parliament and 72 representatives of leading industries. Sir Robert Horne heard a good deal about the abnormal difficulties with which the trade of the country is surrounded. We are not told whether anything of a practically constructive nature was put before him. The information came from several representatives of industries; among them being Mr. D. Milne Watson, who voiced the views of gas and other public utility companies. The President of the Board of Trade could not off-hand do much more than repeat the Government pledge to introduce a Bill dealing with dyes, key industries, dumping, and exchanges as the first important public measure next session. One trouble with which the Government is faced is that what is said to suit

one industry may be detrimental to another; they cannot possibly please all. They will have to do that which will broadly be to the best advantage of the country as a whole. Regarding the question of dyes, home producers and users have agreed on a scheme for establishing a licensing board or committee to control the importation of foreign dyes; and they are urging the Government to pass at once the necessary special legislation for carrying the proposal into effect. The chances of this being done in the present session are not by any means bright.

PERSONAL.

Last Friday night the chief officials of the Darlington Corporation dined with the Town Clerk, when a presentation was made to Mr. F. P. TARRATT, who leaves shortly to take up his new duties as Chief Engineer of the Newcastle and Gateshead Gas Company. The gift was a silver salver, suitably inscribed. The Mayor was present, and joined with the officials in expressing hearty wishes for Mr. Tarratt's future welfare and prosperity.

Dr. LEONARD A. LEVY. M.A. (Cantab.), F.I.C., F.C.S., the Chemist to Messrs. Alexander Wright & Co., Ltd., of Westminster, has been created a "Cavalier of the Crown of Italy."

Mr. WILLIAM CASH, who has been the Secretary of the South African Lighting Association, Ltd., since 1891, has been elected to a seat on the Board; and Mr. WILLIAM CASH, JUN., M.A., A.C.A., has been appointed Secretary in his place.

At the end of November, the position of Coal Controller, which Mr. A. R. DUNCAN had held for the past year, ceased to exist; and, under the Coal Mines Act, all matters affecting the industry will now be dealt with by a new Department of the Board of Trade, over which Mr. W. C. BRIDGEMAN, M.P., is to preside.

Mr. A. W. ELTON, the Engineer and Manager of the Littlehampton Gas Company, has been presented by his friends at Rustington with a framed and illuminated address "as a small token of their esteem and appreciation of his uniform kindness and assistance, both politically and socially, during the past twenty years." At the same time, Mrs. Elton was presented with a handsome mirror in massive frame of oak and embossed brass. Mr. S. H. Caslon, who acted as Chairman during the ceremony, spoke of Mr. Elton's readiness to come forward whenever he could be of assistance.

OBITUARY.

The death took place at Hockley Heath, Birmingham, last Friday of Mr. F. E. MUNTZ, a prominent agriculturist and Governor of the Royal Agricultural Society. He was well known in commercial circles, being Chairman of the Knowle and District Gas Company, a Director of the Littleton Collieries, and Chairman of the Horseley Bridge and Engineering Company.

Increase of Carbonization Advocated.

The annual meeting of the North Staffordshire Institute of Mining Engineers was held last week at Stoke-on-Trent. It was stated that the Institute, which was founded 48 years ago, had a membership of 176. Mr. J. R. L. Allott, of Kidsgrove, was elected President, in succession to Sir John Cadman. Messrs. W. Saint, T. Yates, and F. E. Buckley were elected Vice-Presidents. The new President urged the vital necessity for the most economical utilization of coal in industry. There was most wasteful consumption in domestic fires, as well as in industrial steam-raising systems. For improvement in these directions, he looked for an extension of the processes of carbonization and complete gasification of coal. There were three great factors: (1) The imperative demand for the products of carbonization—liquid fuel for ships, internal combustion engines, &c., ammonia for fertilizers, and products for special chemical industries, &c.; (2) an important demand for some kind of smokeless fuel to replace the coal used for household and industrial purposes; and (3) the need for more economical production of power for mines and factories, and light and heat for the home. He pleaded for an extension in the use of coke-oven gas, in the utilization of gas for domestic heating and industrial purposes, with a corresponding reduction in coal consumption.

A visit will be paid next Saturday afternoon by members of the London and Southern District Junior Gas Association to the East Greenwich works of the South Metropolitan Gas Company.

In the report on p. 456 of last week's "JOURNAL" of the visit of the Midland Junior Gas Association to the Windsor Street gasworks of the Birmingham Corporation, it was stated that the total capacity of the Woodall-Duckham vertical retort installations is 16 million c.ft. per week. This, of course, should have read 16 million c.ft. per day.

COAL AND FUELS DEPARTMENT OF THE LEEDS UNIVERSITY.

Nucleus of a Fund to Increase the Endowment.

WE have received from the President of the Institution of Gas Engineers (Mr. Thomas Goulden, M.Inst.C.E.), a copy of the following letter addressed to him by Dr. Charles Carpenter:

South Metropolitan Gas Company, Nov. 19, 1920.

Dear Mr. President,—It is now eleven years since the proposal was carried into effect of endowing at Leeds University a Professorship of Gas Technology in memory of a Chairman of this Company—the late Sir George Livesey.

Whatever misgivings may have been entertained at the time as to the form the memorial should take, no one doubts to-day that the choice was a wise one, and that it has been in all respects completely justified.

But the endowment, never really sufficient for its purpose, is now, in view both of the developments which have taken place and of the greatly increased cost of scientific work, wholly inadequate.

The Universities, already in a position of grave financial difficulty (which is especially unfortunate just now having regard to the post-war increase of students), are, I think, entitled to look for increased support from those industries to which, by research work and by the scientific training of recruits, they are continually rendering notable service. In this respect it appears to me to be a matter of real national importance that these centres of research and training should be secured of their independence, and should remain free to develop on their own lines, and in friendly co-operation with the industrial world. Whether or not they may obtain a greater measure of support from the State, it would, in my opinion, be disastrous should they become so dependent on Government aid as to bring themselves under bureaucratic or political control.

To the granting of the new Charter which has been bestowed by Parliament upon the gas industry, the work at Leeds largely contributed; and it would seem that the time is appropriate to appeal to the industry to give definite shape to its gratitude by making the Livesey endowment not only more worthy of its object, but more adequate to its needs.

I am authorized by the Board of this Company to say that it is prepared to subscribe one thousand pounds towards a fund for this purpose; and I do so with the more pleasure realizing as I do that your own career is one which has proved the importance of experimental physics as a necessary foundation of engineering achievement.

A sympathetic professional relationship has long existed between the engineers responsible for the conduct of the Metropolitan gas undertakings; and it is a source of great satisfaction to me that the above offer should materialize during the tenure by one of them of the highest position it is in the power of the Institution of Gas Engineers to bestow.—Believe me, &c., (Signed) CHARLES CARPENTER.

THOMAS GOULDEN, Esq., M.Inst.C.E.,
President, The Institution of Gas Engineers.

This letter and the proposal for increasing the endowment of the Coal Gas and Fuels Department at the Leeds University are referred to in our editorial columns this week. It will be seen that the Chairman (Mr. Charles Hunt) and his colleagues on the Board of the South Suburban Gas Company have subscribed £200, which gives the fund a start of £1200. It is the hope that this generous lead will result in the accumulation of a fund that will be worthy of the gas industry and of its position and operations in the country.

A General Appeal.

The University of Leeds is also making a general appeal for funds wherewith to erect and equip additional laboratories and for various other purposes necessary to meet the demands that are being made upon it by an unprecedented increase in the number of undergraduates and of qualified applicants for early admission. There are now over 1600 students taking full-time day courses in preparation for degrees or diplomas. This is two-and-a-half times as many as were in residence the year before the war; and the demand for admission shows no abatement.

The sum now asked for is £500,000; but even this will be insufficient to meet the requirements, unless supplemented by liberal grants from the Government. The new laboratories alone, which are for teaching and research in pure and applied science, are estimated to cost half this sum, while a like amount is desired as an addition to the general endowment fund; and other requirements total nearly as much again as these two put together. The appeal was inaugurated at a public meeting held last week, and presided over by the Lord Mayor of Leeds, when it was announced that towards the fund gifts amounting to £112,800 had already been received or else promised. The needs of the University for additional funds were explained to the meeting by the Chairman of the Council (Mr. Arthur G. Lupton), the Treasurer (the Hon. Rupert E. Beckett), the Vice-Chancellor (Sir Michael E. Sadler), and Prof. Arthur Smithells. Among other speakers was Mr. Thomas Glover, of Norwich. It is proposed that donors should have an opportunity of paying their contributions in instalments over a period of five years, and, if they so desire, of earmarking their gifts to one or more of the special objects enumerated. It is intended that the enlargements and extensions shall be carried out gradually. But immediate action is required to be taken; and before embarking on the scheme the University must be sure of the requisite support. If this is not forthcoming, large numbers of promising students will be put at a disadvantage.

RETURNS RELATING TO GAS COMPANIES.

Official Figures for the Year ended Dec. 31, 1919.

THE break, caused by war-time conditions, in the publication of the Board of Trade Returns relating to Authorized Gas Undertakings in the United Kingdom, was ended last week by the issue of the figures regarding undertakings "other than those of local authorities"—that is to say, of Gas Companies. Those for the Local Authorities have not yet appeared. It may be pointed out that the present issue [Cmd. 1021] is in continuation of Parliamentary Paper No. 311, of Session 1915, which was for the year ended December, 1913, for the Companies, and to March 31, 1914, for the Local Authorities. Those returns were noticed in the "JOURNAL" for April 18, 1916 [p. 124]. Subsequently, the Board of Trade announced that they did not propose to publish the returns for 1914. They, however, caused a summary to be made of certain of the particulars contained in the returns; and this was reproduced in the "JOURNAL" for July 18, 1916 [p. 108].

The undertakings with regard to which particulars are to be found in the return number 505 (excluding six undertakings not furnishing returns). In 1914, the number was 518; and in 1913, 519. Those that have dropped out since the earlier year, in consequence of amalgamations, purchases, &c., are: Ashbourne, Chelmsford, Christchurch, Dartford, Enfield, Eton, Hythe and Sandgate, Longwood, North Ormesby, North Sussex, Porthcawl, Skegness, Slaithwaite, Staines, and Sunbury. The new comers are: Edenbridge, Heathfield and Waldron, Hightown Gas and Electricity, Kenilworth, Wadhurst and District, Whitwell and District, and Woodhall Spa.

The total amount of the companies' capital (share and stock) authorized is stated at £98,295,361. In 1914, information was not available; but for 1913 the figure was £90,424,862. The amount of share or stock capital (with premiums) showed in the present return as having been paid up is £83,494,319, which compares with £78,903,298 in 1913. The total loan capital authorized is now £27,392,007; and the amount issued, £18,318,312. The receipts for the three years are given as: 1913, £23,296,963; 1914, £22,814,641; 1919, £43,037,484. The expenditure is: 1913, £18,580,794; 1914, £18,556,692; and 1919, £39,134,309. The following table will enable these figures to be compared with those of earlier years.

Financial Position Summarized.

Year.	Share and Premium Capital Paid up.	Loan Capital Issued.	Receipts.	Expenditure.
	£	£	£	£
1904. . .	68,953,306	13,775,734	17,828,872	13,397,727
1905. . .	70,605,726	14,176,599	17,617,598	13,410,307
1906. . .	72,008,451	14,467,842	18,166,087	13,671,369
1907. . .	73,152,891	14,645,271	19,567,336	14,884,982
1908. . .	74,328,645	14,944,060	20,013,159	15,475,933
1909. . .	74,952,664	15,168,298	19,951,779	15,097,658
1910. . .	76,797,028	15,396,163	20,446,438	15,308,928
1911. . .	77,382,751	15,606,929	21,134,770	15,903,361
1912. . .	77,963,589	15,816,405	22,358,030	17,231,015
1913. . .	78,903,298	16,269,757	23,296,963	18,580,794
1914. . .	*	*	22,814,641	18,556,692
1919. . .	83,494,319	18,318,312	43,937,484	39,134,309

* Information not available.

In 1919, the quantity of coal carbonized by the companies was 10,596,697 tons; in 1914, 9,836,265 tons; in 1913, 10,118,399 tons. The total quantity of gas made for the three years was: 1919, 160,826,784,000 c.ft.; 1914, 145,847,410,000 c.ft.; and 1913, 142,251,637,000 c.ft. The quantity of gas sold was: 1919, 145,880,443,000 c.ft.; 1914, 132,839,119,000 c.ft.; and 1913, 130,175,199,000 c.ft. These figures, with those of earlier years, are set out in the table. The total length of mains belonging to the companies was in 1919 24,079 miles, in 1913 23,697 miles; and the public lamps supplied numbered 273,100 in 1919, and 375,056 in 1913. The figures for the total number of consumers are: 1913, 4,214,865; 1914, 4,342,692; and 1919, 4,510,595.

Year.	Tons of Coal Carbonized.	Cubic Feet of Gas Made.	Cubic Feet of Gas Sold.	Number of Consumers.
1904	8,673,343	105,311,980,000	97,255,155,000	2,588,917
1905	8,722,145	109,823,682,000	100,848,445,000	2,813,156
1906	8,922,781	114,528,923,000	105,218,682,000	3,023,619
1907	9,240,280	118,699,705,000	108,239,449,000	3,230,993
1908	9,281,738	119,985,109,000	109,316,716,000	3,399,193
1909	9,175,532	122,930,431,000	112,334,153,000	3,573,796
1910	9,236,081	125,830,234,000	115,342,163,000	3,751,703
1911	9,431,841	130,562,246,000	119,497,425,000	3,906,528
1912	9,563,219	137,007,569,000	126,001,893,000	4,062,289
1913	10,118,399	142,251,637,000	130,175,199,000	4,214,865
1914	9,836,265	145,847,410,000	132,839,119,000	4,342,692
1919	10,596,697	160,826,784,000*	145,880,443,000	4,510,595

* Including 28,723,808,000 c.ft. of water gas, and 4,487,047,000 c.ft. of "other gas."

As on the last occasion, the information contained in the return is set out in twenty-three columns, with precisely the same headings. Under "Nature and quantity of other materials used for the manufacture of gas," oil, of course, figures most largely; but a good many companies make a return of coke used. Eckington and Mosborough employed 150 gallons of benzole and 500 gallons of tar; Cardiff, 29,540 tons of coke and breeze; Swansea, 1021 tons of anthracite; Aldershot, 19 tons of cannel; Gravesend, 9655 gallons of carburine spirit; Isle of Thanet, 836 gallons of enriching spirit; Sevenoaks, 696 gallons of benzole; Sittingbourne, 502 tons of coke and coke breeze; Hightown, 450 gallons of petrol; Cleethorpes, 200 gallons of benzole; Grantham, 3612 gallons of gazine and 796 gallons of carburine spirit; Uxbridge, 545 tons of breeze; King's Lynn, 1050 gallons of benzole; Kingston-on-Thames, 3398 chaldrons of breeze and 4935 gallons of benzole; Brighton and Hove, 6912 gallons of benzole; and Dublin, 4134 tons of breeze.

Of the 4,487,047,000 c.ft. of gas made other than coal or water gas, no less than 4,351,760,000 c.ft. was made by the South Staffordshire Mond Company, whose output in 1913 was 4,846,950,000 c.ft. Footnotes to the tables indicate a number of cases in which gas was bought by companies in bulk; and quantities so sold by them are also shown. The Hightown Gas and Electricity Company supplied 450,000 c.ft. of petrol air gas.

In view of the conditions under which gas-works have been operating, the water-gas figures will no doubt excite special interest on the present occasion; and our customary table dealing with this matter is therefore reproduced brought up to date. The total make of water gas by the companies in 1919 was 28,723,808,000 c.ft., which compares with 23,767,825,000 c.ft. in 1914, and 18,392,121,000 c.ft. in 1913.

Companies Stating Percentages of Water Gas Supplied.

Abingdon [max., 20; av., 10].
Aldershot [max., 45·3; av., 24·1].
Alliance and Dublin [max., 48·07; av., 38·65].
Aylesbury [max., 30; av., 10 to 15].
Barnet [max., 40·9; av., 23·9].
Bath [max., 38; av., 21].
Bexhill [max.. 43·15; av., 28·02].
Bilston‖ [max., 19; av., not stated].
Bishop's Stortford [max., 43·9; av., 36·4].
Bognor [max., 25; av., 10].
Bournemouth [max., 45; av., 39 5].
Brentford [max., 51·2; av., 43·65].
Bridgwater* [max., 15; av., 15].
Bridlington [max., 55·38; av., 38·95].
Brighton [max., 48·17; av., 40·25].
Bristol [max., 25·17; av., 14·78].
Budleigh Salterton [max., 40; av., 20].
Cambridge [max., 25; av., 19].
Cardiff [max., 53·5; av., 35·7].
Cleethorpes [max., 23; av., 18].
Colchester [max., 62·4; av., 40].
Commercial [max., 40·63; av., 26·27].
Croydon [max., 48·8; av., 31].
Derby [max., 28; av., 17·38].
Dorchester [max., 41·9; av., 24·5].
Dorking [max., 30; av., 20].
Dudley [max., 48·1; av., 35·1]
Durham [max., 8·5; av., 4·2].
Eastbourne [max., 40; av., 18].
East Hull [max., 46·5; av., 29·47].
Eckington and Mosborough [max., 50; av., 44].
Falmouth* [max., 25; av., 20].
Farnham [max. 29; av., 23].
Felixstowe [max., 28; av., 15·5].
Fleetwood [max., 11; av., 9·5].
Folkestone [max., 25; av., 11].
Frodsham [max., 35; av., 28·78].
Gas Light and Coke Co. [max., 28·1; av., 23·62].
Gorleston [max., 33; av., 28].
Gosport [max., 45; av., 32·4].
Gravesend‡ [max., 40; av., 32·4].
Grays and Tilbury [max., 44; av., 20·8].
Guildford [max., 30; av., 20].
Hampton Court [max., 32; av., 22].
Harrow [max., 51; av., 38].
Hartlepool [max., 27·97; av. 15·64].
Hastings [max., 39·26; av., 29·57].
Hornsey [max., 56; av., 42].
Horsham [max., 38·5; av., 25·9].
Hull—British [max., 53·5; av., 32·9].
Ilford [max., 41·94; av., 24·18].
Ipswich [max., 32·38; av., 26·87].
King's Lynn [max., 26·9; av., 17·9].
Kingston-upon-Thames [max., 50; av., 30].
Lea Bridge [max., not stated; av., 35].
Leamington [max., 39·1; av., 16·1].
Lewes [max., 41; av., 17·29].
Liverpool [max., 45·94; av., 38·10].
Londonderry [max., 33·3; av., 14].
Luton [max., 9; av., 5].
Maidenhead [max., 54; av., 48].
Maidstone* [max., 26; av., 18].
Malton [max., 47; av., not stated].
Marlborough* [max., 65; av., 14·7].
Matlock [max., 3·7; av., 3·3].
Merthyr Tydfil [max., 18; av., 10].
Mid Kent [max., 59; av., 28].
Newcastle-upon-Tyne [max., 15·43; av., 7·60 for one week].
Newport (Mon.) [max., 30·3; av., 22·9].
North Middlesex [max., 55·74; av., 46·08].
Norwich—British [max., 55·8; av., 39·7].
Ormskirk [max., 40; av.. 25].
Pembroke [max., 50 1; av., 30 6].
Pontypool [max., 16; av. 6·3].
Portsea Island [max., 27·7; av., 16·3].
Prescot [max., 31·4; av., 12·3].
Preston [max., 28; av., 6·5].
Plymouth† [max., not stated; av., 44].
Reading [max., 49·7; av., 38·1].
Redditch [max., 26·11; av., 1·6].
Redhill [max., 29·29; av., 9·51].
Ripley [max., 21; av., 8·24].
Rochester [max., 50·45; av., 33·94].
Romford [max., not stated; av., 35·38].
Rugby [max., 48; av., 32·4].
Rushden and Higham Ferrers [max., 39·17; av., 22·47].
Salisbury* [max., 40; av., 32·94].
Scarborough [max., 59; av., 35].
Sheffield [max., 6·5; av., 0·67].
Sheppey [max., 29·9; av., 18·35].
Southampton [max., not stated; av., 35·9].
Southend [max., 41·83; av., 32·38].
Southgate [max., 51·7; av., 46·2].
South Shields [max., 23; av., 11·38].
South Suburban [max., 30; av., 24·9].
St. Albans [max., 46; av., 30].
St. Austell [max., 20; av., 15].
Stamford [max., 33·3; av., 3].
Staveley [max., 40; av., 22·8].
Stretford [max., 29·61; av., 19·18].
Sutton and Hooton [max., 20; av., 20].
Swansea [max., not stated; av., 39·26].

Swindon United [max., 32·22; av., 22·1].
Taunton* [max., 45; av., 38].
Tonbridge [max., 50; av., 46·6].
Torquay [max., 55; av., 37·4].
Tottenham [max., 40; av., 34·2].
Tunbridge Wells [max., 30; av., 25].
Uxbridge [max., not stated; av., 1·3].
Waltham Abbey [max., 32·7; av., 9·6].
Wandsworth [max., 30·2; av., 21·63].
Warwick† [max., 19·5; av., 7·7].
Watford [max., 28; av., 14].
Wells† [max., 10; av., 1·8].
Weston-super-Mare [max., 40; av., 17·9].
Wexford* [max., 30; av., 17].
Weymouth [max., 30; av., 20].
Winchester [max., 52; av., 41].
Woking [max., 20·2; av., 12·5].
Wolverhampton [max., 45·95; av., 31·88].
Yorktown [max., 24·5; av., 18·78].
York [max., 34·8; av., 22·82].

* The return is for year ended June 30, 1919.
† " " " " " March 31, 1919.
‡ The return is for June 24, 1919.
‖ For year ended Sept. 30, 1919.

An indication is given in the return of those Companies with whom the price chargeable and the rates of dividend payable are regulated by an Order under the Statutory Undertakings (Temporary Increase of Charges) Act, as well as of those having a standard of calorific value.

The quantity of gas supplied in 1919 by Companies to ordinary consumers was 92,551,580,000 c.ft.; to prepayment consumers, 50,641,548,000 c.ft.; for public lamps, 2,687,315,000 c.ft. For 1913, the 130,175,199,000 c.ft. sold was divided-up as follows: Ordinary consumers, 90,141,743,000 c.ft.; prepayment consumers, 34,312,075,000 c.ft.; public lamps, 5,721,381,000 c.ft. Of the consumers in the present return 2,693,890 were prepayment, and 1,816,705 ordinary; the figures for 1913 being 2,473,592 prepayment, and 1,741,273 ordinary.

A Standard for Gas Tubing.

The authorities in Newark (N.J.), having determined to try to lessen the accidents due to defective gas tubing and rubber ends, issued a new set of standards and regulations which must be conformed to by all flexible tubing and hose sold in the city for the purpose of conveying gas. According to these rules, all gas tubing must be strong enough to lift from the floor and hold for 15 minutes a weight of at least 25 lbs. without breaking or leaking after the test. Rubber end-pieces must be attached in a manner to stand the same test. Tubing must stand, without crushing or shutting-off the flow of gas, a weight of 100 lbs. per linear inch without leaking. The quality of the rubber end-pieces must be such that a section of 1 in. square will stretch to at least 3 in. long. Rubber end-pieces must be at least 2 in. long, and must have a minimum thickness of 5-32 in. at the gas appliance end. When attached to metal hose, an approved metal clamp or equivalent must also be tightly fastened to the rubber end-piece where it is attached to the tubing. At least ¾-in. of the rubber end-piece must be left free for attaching to the gas appliance. It seems that during the early winter season last year there were nine deaths due to the use of defective gas tubing in the homes of consumers in the city; and some of these accidents were directly traceable to the quality and type of rubber end-pieces employed.

An Export Register.—The Export Register of the Federation of British Industries should prove invaluable both to British manufacturing firms and to buyers the world over. It has been well arranged on lines to afford easy reference; being divided into sections, each with its distinctive heading, while the items of the sections are given cross-references to other sections. The book bears ample testimony to the important position which has been taken by the Federation of British Industries, whose aims are such as commend it to all who have at heart, from an individual and a national point of view, the commercial interests of this country. We are told (and glancing at the volume before us, it can be readily believed) that every important manufacture in the United Kingdom is represented by firms who are full members of the Federation. The compilation of this Export Register must have entailed a vast amount of work; but its usefulness will be proportionate to the labour that has been bestowed upon it. The offices of the Federation are at No. 39, St. James's Street, S.W.

Coal Saving in the Chemical Industry.—The investigations into the working of steam-boiler plants carried out by Mr. David Brownlie, B.Sc. Hons. (Lond.), F.C.S., are already well known; and now there is brought to our notice (by Messrs. Brownlie and Green, Ltd., of Church Street, Cheetham, Manchester) a reprint of another article by him from the "Chemical Trade Journal and Chemical Engineer," which deals specially with the scientific control of steam-boiler plants in the chemical industry. The article contains the results of some ten years' investigations into the working of the steam-raising plants at sixty different chemical works, devoted to the manufacture of various substances; and exact details of the performance of each plant are set forth in tabular form. He shows that the net working efficiency of these plants is only about 58 p.ct., and claims that, by carrying out the re-organization of these plants on modern scientific lines, it is quite possible to get this figure up to well over 70 p.ct., with a consequent saving of more than 20 p.ct. in the coal bill. The great importance of such a saving both from a national and profit-earning point of view, calls for careful consideration of this contribution by Mr. Brownlie to the subjects of fuel economy and steam generation.

ELECTRICITY SUPPLY MEMORANDA.

THE reorganization of electricity generation is the matter that is uppermost in the minds of the owners of electricity undertakings—not that they all wish for reorganization to come about in the manner provided by the Electricity Supply Act which was pushed through Parliament at the last moment in the 1919 session. But they see no help for it with the Electricity Commissioners engineering matters; and they discern compulsory enactment on the horizon if they do not make a voluntary move. There are many who would like the power to get exemption; but this would ruin the aims and objects of the new legislation. A writer in "The Times Engineering Supplement" is obviously distressed over the slow progress that is being made with the reorganizing work. He expects too much. Progress is bound to be slow. It is a big task that the Commissioners have in hand—a task covering the whole country, a multitude of interests, and a quantity of work which is incapable of being estimated until those concerned come to close grips with it in each division of the country constituting an electrical area. In carrying out the preliminaries of such work, and forming the Joint Authorities, time must be absorbed; and then there will be all the tedious and expensive work of materialization. There was a certain amount of enthusiasm after the excision from the original Bill of the clauses calling for the formation of District Boards, and conferring the powers of compulsory purchase; the owners of electrical concerns gladly grasping the principle of voluntary association as a way to extinguish the idea of District Boards and compulsory acquisition, which would have left to them only the rôle of purveyors of energy produced by another body. The enthusiasm regarding voluntary association for the purpose of electricity generating reorganization is already on the wane; and many authorities would now prefer to be left in unfettered possession and control of all they possess. The correspondent of "The Times Engineering Supplement" appears to regard the Joint Authorities as cumbrous means of attaining the object; and he looks for a shorter cut or middle way to achievement than the one which has revived local differences and jealousies in such an acute form. He finds the real source of delay arises through the Joint Authority being a proprietary affair. Financial responsibility, too, is involved; and this has to be apportioned among parties whose relative responsibility is almost indeterminable.

"Slow Progress."

The view of the correspondent is that if it were possible for the Joint Authority to be simply a board of control in the first instance, the whole situation would be modified. In many cases an existing undertaking or group of undertakings would be willing, if allowed, to proceed on a big scale, and would do this subject to any reasonable arrangements for subsequent control or purchase by a Joint Authority. The roots of such a plan are found planted in places like Rotherham, Manchester, and Nottingham, to the Corporations of which the Electricity Commissioners have granted powers for carrying out extensive generating schemes. As a matter of fact, it is difficult, in the writer's view, to imagine that anything practical can be set afoot at once except on some such lines as he indicates. He sees no disadvantages in allowing individual groups going ahead, and the advantages in the way of speeding-up would, he thinks, be enormous. Of course, a start has to be made somewhere; but the writer's plan ignores the undertakings that, less affluent and less well circumstanced, require the earliest possible assistance. Nor does he look forward to the time when reorganization on a national basis would have to be carried to the next stages. The strong individual groups might then have grown so powerful electrically that they would be more reluctant than ever to throw in their lot with the minor concerns farther afield, and thus reduce the advantages that consolidation in their own picked areas of larger demand conferred upon them. That would not be the objective that is now being sought. We may be wrong; and so may be the writer in the "Engineering Supplement." He sees simplification and easy-going his way; we fancy there are in it stronger complications and hardened resistance to be encountered in future. He sees in the Electricity Commissioners the public safeguard. His object, of course, is good, and that is to make a start, and get something accomplished as soon as possible. But the Joint Authority must be fully formed at the initial stages, or trouble must ensue.

A Speeding-Up Plan.

There have been a good many strictures lately on the use of gasfilled electric lamps. Electrical critics who look for propriety in application have been severe, but none too severe, on the lighting crudeness that is now to be seen in abundance in shop windows, defying all the scientific laws that the Illuminating Engineering Society have been laboriously promulgating among lighting practitioners. Dazzling concentrated lights are exposed to the eyes of the person who would make inspection of goods in the shop windows, but who, after a few minutes' eye torture, turns away in disgust at finding vision blurred, and that the goods do not appear to be what he or she expected them to be. It is a case with shopkeepers of following the leader, and of being in the supposed fashion—nothing more. There is no over-all saving in the employment of such lamps;

Dazzling Lights or Utility?

and utility is not considered. The day will probably arrive when shopkeepers will learn that window lights are intended to aid in the sale of their goods, and should not be the chief attraction for the eye, and an attraction that does damage to the primary object. The "Electrician" has been consistent in its protest over this matter. In a recent issue it again draws attention to "the harm that is being done not only to the eyesight of the nation, but to the good name of the electrical industry, by the wrongful methods of installing high candle power lamps." High candle power lamps would not matter much, if they were not of high intensive brilliancy. Our contemporary says that examples of what it means are to be found without search; for they are forced upon attention with unpleasant suddenness. But what interests the "Electrician" most is not the damage to the public eyesight (that is what does interest us most), but the state of mind of the electrical contractors who abet such atrocities, and of the supply authorities who permit such damaging advertisements to go unchallenged. The secret of it is that the contractors and the supply authorities who wink their eyes at this abuse of scientific knowledge and application, have only one thing in view, and that is business, and be hanged to the damage it does to other people. They know, too, that the major number of shopkeepers do not want to incur the expense of shades or bowls, and reflectors; and the initial change from the lower intrinsic brilliancy metallic filament (bad as it is) to the gasfilled lamp is only a step to additional business in glassware of various orders but high cost, when shopkeepers awaken to the truth of the position.

Electricity and the Convalescence of Industry.

We have been reading Mr. J. R. Beard's address to the North-Eastern Centre of the Institution of Electrical Engineers, on "Post-War Conditions in Electricity Supply." It is highly interesting. We all want the country to make a speedy recovery from the effects of the war—effects of unprecedented severity. After the last Napoleonic wars, the general application of steam power to industry was the main source of England's recovery. Mr. Beard is under the impression that history is going to repeat itself. But recovery is not such an easy task to-day. What steam did for the country in those days, he thinks electric power is going to do to-day. We suggest to him that he might allow gas to have a look-in after electric-motors have taken their place for minor powers and intermittent operation; and he might also recognize that labour-saving sources of heat in industry are to-day equally as important as power. When such recognition is made, then there will be greater happiness and a saner outlook. Industry would to-day be in a fearfully precarious position if our industrial recovery was confided to electricity alone, and all other tributaries to the provision of the industrial convalescence were neglected. Mr. Beard thinks that the application of electricity will result in a considerable reduction of smoke. So will the application of gas; and as the myriads of domestic chimneys in the aggregate are greater sinners in the matter of air pollution than the industrial chimney, the gas industry submits, with all humility, that it hopes to make (if anything) a bigger contribution to air sanitation than the electrical industry. The beautiful picture as to the electric age that was recently word-painted in "The Times," and which was noticed in the "Memoranda" last week, rises before us as we read Mr. Beard's words. The picture was only beautiful in what it presented from imagination; it was grotesque in that its realization to the fullness of its vivid conception is totally impracticable.

Costs and Other Matters.

Mr. Beard does refer to the gas industry, but not in connection with smoke abatement—at least we gather so from the published abstract. He finds that the average cost of engineering labour has increased by approximately 323 p.ct., while the corresponding average rise in the cost of engineering materials is 340 p.ct. Nevertheless, in his opinion, electrical transmission and distribution are relatively favourably situated as regards material (owing to the comparatively low increase in the prices of copper and lead), and the industry also benefits from the small proportion of unskilled labour employed. We were under the impression there has been a considerable amount of trouble of late over the wages and hours of the skilled electrical men. In general, therefore, Mr. Beard opines that the electricity industry has not been affected by the changed conditions any more than the gas industry. Probably it has not. We do not say it has. But when capital represented (say) 50 p.ct. of the electricity industry's costs before the war, and the very nature of its plant, distribution work, and electricity using appliances caused these to be more expensive than the corresponding plant and appliances of the gas industry, then an equal percentage increase in costs would make a difference between the two industries—not in favour of electricity. A 300 p.ct. increase of £1 makes a total of £4; a 300 p.ct. increase of 15s. makes a total of £3. Supposing the £1 represented the electricity industry before the war and the 15s. the gas industry, the 5s. difference before the war would have risen to £1 now. It does not follow from the mere application of an even percentage advance that the one industry has not been affected more than the other. It is a matter to which generalities will not apply. Mr. Beard pleads for the greatest economy and efficiency being brought to bear upon costs. He believes, too, that the co-ordination of railway electrification to the general power supply will have a great influence in facilitating the development of transmission systems. Among his data is found this interesting item: The capital cost per KW. of a consumer's maximum demand in the case of lighting only is £55·3; while in the case of lighting with occasional heating and cooking, the cost is reduced to £17·5 per KW.; and in the case of the all-electric consumer is further reduced to £12·5 per KW. It is also pointed out that if economies are to be effected from power factor correction, the industrial consumer must be penalized for bad power factor. There is a developing view that power tariffs should be constructed on a sliding-scale with power factor at the base—that is to say, as the power factor diminishes, the price should ascend. This should improve the status of power competitors.

Cheap Wiring for Small Houses.

A very pointed letter on this subject has appeared in the "Electrical Review" from Mr. E. A. Pinto, of Ramsgate. Our contemporary published a statement that the price to be paid for lighting installations in the Hythe housing scheme is 28s. 6d. per point. The correspondent does not believe satisfactory work can be done at this figure. He says he has a copy of the specification for the work; and from this it appears there are to be seven points in each house. The wiring is to be "laid in steel conduit tubing with the necessary solid (not split) elbows, bends, tees, &c., and with slip-joints." "All connections to be properly formed to ensure continuity throughout." "The whole to be formed in two circuits with a proper distribution board, with fuses to control each circuit." "All distribution boards to have ordinary 5-am. cut-outs." Each house is to have a D.P. main switch and a pair of fuses, and each point is to be complete with a H.V. metal-filament lamp and an opal shade. Mr. Pinto quite fails to see how this specification can be complied with (under present conditions) at 28s. 6d. per complete point. A second question raised by this contract is the responsibility for the design of the installation by a competent electrical engineer. It will have been noticed from the above that the tubing is to be "slip socket," and that continuity is to be obtained. The attention of the Borough Surveyor who issued the specification was drawn to this point by an inquiry as to the grip-fittings to be used. He replied: "Surely it is possible even with slip-joints to ensure continuity throughout. There is no intention of using grip-fittings, as this will considerably increase the price." If (says Mr. Pinto) this absurd specification is a fair specimen of the working of the Hythe housing scheme or of that of other towns, these houses will be truly "homes for heroes"—indeed, it will need a hero to inhabit one!

HEAT AND LIGHT IN LAUNDRIES.

WHERE washing is to be done, in either large or small quantities, gas is able to offer most valuable assistance. In fact, under many conditions it must by this time have come to be regarded as an absolute necessity. It was therefore not surprising to find it substantially represented last week in the Royal Agricultural Hall, Islington, when the International Laundry and Allied Trades Exhibition was held, with Mr. F. W. Bridges as Organizing Manager. Seven years have elapsed since the last exhibition of a similar character; and now co-operation has succeeded in getting together a display for which the claim was advanced that it demonstrated "that everything required for the proper and efficient equipment of laundries, large or small, can be supplied in the Old Country, notwithstanding the upheaval caused by the war." So far as gas is concerned, this is the case; and no doubt the assertion is equally correct in other directions.

Gas for Ironing and Lighting.

Gas irons, of course, were to be seen on various stands, as being among the first requirements of the housewife or the laundress. There was a good selection of different sized irons for use with high-pressure gas displayed by the James Keith and Blackman Company, Ltd., of Farringdon Avenue, E.C., who had for demonstration purposes a belt-driven rotary gas-compressor, supplying gas at 3-lbs. pressure. Attention was drawn to the special form of control cocks with which these irons are provided, and their special method of suspending the rubber tube, to avoid possibility of kinking or interference with the work. The Company also make a collar machine, with burner and equipment for use on a high-pressure gas supply. The lighting of the stand was effected by Keith patent high-pressure inverted fittings, supplied with gas from the compressor referred to.

Another display on somewhat similar lines was made by Messrs. J. & W. B. Smith, of Farringdon Road, E.C., who had in operation their improved "Cook" belt-driven double-acting compressor for the supply of high-pressure gas. There were also to be seen the firm's high-pressure hand-irons in different sizes, and their high or low pressure soldering irons, for which a small gas consumption is claimed. Then there were the machine burners, specially regulated so as to make it impossible for the operator to prevent perfect combustion—the mixture of gas and air being automatic. For lighting, there were the "Silva" inverted cluster lamps, which are expressly made for laundry and factory lighting, as well as other lighting units to meet varied requirements.

Bonecourt Gas-Fired Boilers.

For generating steam and for heating purposes, there is the Spencer-Bonecourt patent gas-fired boiler, which could be

examined in use at the exhibition. The series of small boilers of this type—of extremely workmanlike appearance—embraces five sizes; and that which was seen at work (the smallest but one) was equal to an output of 250 lbs. of steam per hour, working on town gas. Its approximate dimensions are no more than 1¾ ft. by 5½ ft.; and in this connection it should be pointed out that the whole length of the boiler is used for steam-raising. There is no fire-box, so that it is all giving duty. It possesses so many advantages which are obvious at a glance, that one felt no surprise on hearing that large numbers of these boilers are being sold. No brick-setting is required; they can be simply placed on the floor on their cradles. No stoker is needed; all that is called for being an occasional glance at the water-gauge. They can, in fact, be rendered entirely self-acting, if working on a closed circuit or when fitted with a feed-water regulator. From what has been said as to its dimensions, it will have been gathered that a boiler of this kind takes up no space worth speaking of; and it can be placed right alongside the machines it is intended to give steam to, thus doing away with long steam-pipes. In this particular little boiler, it was said, 80 lbs. of steam had been raised in nineteen minutes, starting from cold.

The range of the series of five small boilers is from 90 lbs. of steam per hour (producer gas) to 1500 lbs. (town gas); and the normal working pressure is 120 lbs. per sq. in. All of them work on natural draught; the thermal efficiency by this means being about 85 p.ct., going up to 90 p.ct. if used with forced draught on bigger units. A point of the first importance, of course, in connection with laundry work—and that is really what for the moment is in mind, though any number of other uses for the boiler at once suggest themselves—is cleanliness; and here the gas-boiler is perfection. Then there is the ease of control, which eliminates stand-by and other losses. Any proportion of the series of jets fitted to the boiler can be lighted—from one to the full number; and directly the machine to which the boiler is giving steam is put out of use, the jets are turned off, without a single second's waste of gas. The value of these considerations, and of the advantages previously pointed out, is hardly likely to be overlooked. The makers are Messrs. Spencer Bonecourt, Ltd., of Parliament Mansions, Victoria Street, S.W.

The Turbine Patent Furnace.

Another exhibit in connection with steam-raising was that of the Turbine Furnace Company, Ltd., of No. 5, Budge Row, E.C., who showed their patent forced-draught "Turbine" furnace, as applied to various types of boilers. Many of these furnaces have already been, and are now being, installed in gas-works. It is explained that they are designed on the well-known principle of the "impulse" turbine—the air trough being comparable to the nozzle, and the fire-bars to the blades of the turbine. The air trough is of diminishing section, thus assuring an even flow of air for combustion. The air is forced between the bars (shaped like the blades of a turbine), which offer a minimum of resistance; and each fire-bar receives an equal amount of air, which is distributed in the form of fine sprays through the narrow spaces provided, so that a maximum of energy with a minimum of force is obtained.

There are various other features in connection with the furnace which are worthy of attention. Special consideration has been given to the velocity and expansion of steam, flow of air, frictional losses, &c., with the result that a maximum of draught is said to be obtained with a minimum of steam. The furnace is easily fitted or taken out for boiler inspection.

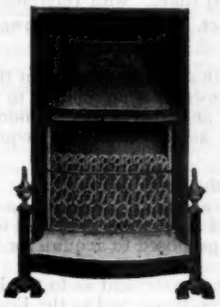
ARTISTRY AND GAS-GRATES.

A WEEK or two ago, we gave a detailed description of the "Classic" series of gas-grates then about to be introduced by Messrs. John Wright and Co., Ltd.; and readers will doubtless

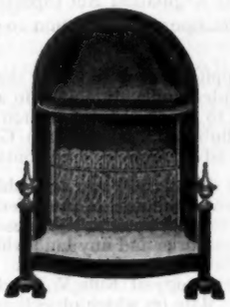
The "Raphael" (Side View).

now be interested to see a few illustrations representative of the large range of new designs embraced in the "Classic" series. The appropriateness of the term "artistry," which the firm apply in their catalogue to these designs, will be recognized.

The "Raphael" is a dog-grate, intended to stand in a recess. It forms a combination of refined design and skilled workmanship.



The "Inigo."



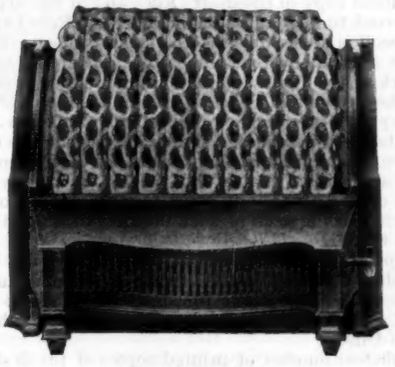
The "Holbein."

The "Inigo" grate relies for its attractive effect upon delicacy of outline, rather than the presence of detail. It can be used as a "built-in" grate if desired.

The "Holbein" is identical with the "Inigo," except for its round top, and is also available as a "built-in" grate.

The "Chantrey."

The feature of the "Chantrey" is its ledge top. Once again the design is of refined outline, with only a moderate use of ornament, and lends itself to being treated as a "built-in" grate.



The "Hotspur."

The "Hotspur" is the newest apparatus for converting a coal-grate into a gas-grate; and there is claimed for it both high efficiency and an extremely low maintenance cost.

Cleaning Blast-Furnace Gas.—Major H. G. Scott, the new President of the Cleveland Institution of Engineers, in his Presidential Address, observed that the cleaning of blast-furnace gas had not made great strides in a forward direction. What was required was some simple method which would extract the dust from the gas without decreasing its calorific value. The Helberg-Beth system, which was very good for moderate amounts, was not sufficiently simple for large quantities of gas. The electro-static process was being tried at Skinningrove; and an American system was to be tested in the district. It was claimed that by this latter process the sensible heat of the gas was retained. Whether or not all the advantages that were promised to result from the cleaning of blast-furnace gas were obtained, a new factor had arisen which might strongly influence the universal adoption of gas-cleaning plants. This was the recovery of potash from the finer particles of dust. It had been found that this valuable fertilizer existed in the dust to an extent equivalent to from 3 to 14 p.ct. of the total weight of the dust in the gas.

APPLICATIONS FOR SPECIAL ORDERS.

Statutory Rules and Orders.

THE Board of Trade have issued—under date of Nov. 16—the "Gas Regulation Act (Special Orders) Rules," with reference to applications under section 10 of the Act. They are as follows:

I.

Applicants for an Order shall publish an advertisement of their intended application once in a local newspaper circulating in the area to which the application relates, and also in the "London," "Edinburgh," or "Dublin Gazette" as the case may require. The advertisement shall contain:

(1) The description and address of the applicants.
(2) A statement of the objects of the application, including a description of any proposed area of supply, any proposed new works and any land which it is proposed to acquire for the purpose of gas-works.
(3) A copy of Rule V., together with a statement as to the last date on which objections may be dispatched to the Board of Trade in accordance with that rule.
(4) A list of the places at which a copy of the draft Order and of the map and plan (if any) has been deposited for public inspection.
(5) The address of an office at which copies of the draft Order may be obtained at a price of not more than two shillings each.

II.

On or before the date on which publication of the advertisement is completed, the applicants shall serve a copy of the advertisement by registered post

(1) On every authority, company, or person supplying, or authorized to supply, gas within the area to which the application relates.
(2) On the owner, or reputed owner, lessee, and occupier of every dwelling-house situate within 300 yards of any land proposed to be used for the construction of works for the manufacture or storage of gas or the manufacture or conversion of residual products, and on the local authority of the district in which any part of such land is situate.
(3) On the local authority and the road authority of every district within which the applicants desire power to supply gas or to break up roads.
(4) On the owner and lessee of every railway, tramway, or canal along or across which it is proposed to lay any pipes or otherwise to affect or interfere with.

III.

On or before the date on which publication of the advertisement is completed, the applicants shall deposit.

(1) A printed copy of the draft Order and of the map and plan referred to in paragraphs iv. and v. of Rule IV. for public inspection at the office of the local authority of every district affected by the application and at the office of the Clerk of the Peace in England and Wales or of the Clerk of the Crown and Peace in Ireland (as the case may be) of every county, riding, or division to which the application relates. In Scotland, a similar deposit shall be made at the office of the principal sheriff clerk for each county to which the application relates, and, where any county is divided into districts for sheriff court purposes, at the office of the sheriff clerk in each of such districts to which the application relates.
(2) A copy of the draft Order at the Home Office, Ministry of Health, Office of Works, Office of Woods, and General Post Office, and, where the draft Order affects the Duchy of Lancaster or the Duchy of Cornwall, at the office of such Duchy.
(3) A sufficient number of printed copies of the draft Order at the office named in the advertisement for public inspection, and for sale to all persons applying therefor at a price of not more than 2s. each.

IV.

(1) The application for an Order shall be made in writing to the Secretary, Board of Trade, Great George Street, London, S.W. 1.

(2) Within seven days of the date on which publication of the advertisement is completed, the applicants shall deposit at the office of the Board of Trade

(i) A copy of the newspaper and "Gazette" containing the advertisement.
(ii) A complete list of the names and addresses of the authorities, companies, and persons upon whom a copy of the advertisement has been served in accordance with paragraphs (1), (2), (3), and (4) respectively of Rule II.
(iii) Four copies of the draft Order.
(iv) An ordnance map, on a scale of 6 in. to the mile, showing the boundaries of the existing and proposed area of supply, and the situation of the existing and any proposed works.
(v) Where it is proposed to authorize the use of any land for the construction of gas-works, a plan of the site of the land on a scale of not less than a quarter of an inch to every 100 ft.
(vi) Where the applicants are a local authority and additional borrowing powers are sought:
  (*a*) A statement of the amounts borrowed and authorized to be borrowed for the purposes of the gas undertaking.
  (*b*) A statement showing under separate heads the purposes for which additional borrowing powers are required, and the amounts required for each purpose.
(vii) Where the applicants are not a local authority:
  (*a*) A statement of the existing capital (share and loan) showing the amount authorized, raised, and expended.
  (*b*) A statement showing under separate heads the purposes for which additional capital is required, and the amounts required for each purpose.
(viii) A copy of the printed accounts of the undertaking for the half year or year preceding the application.
(ix) If the applicants are a company incorporated under the provisions of the Companies Acts, a copy of their memorandum and articles of association and of every registered special resolution of the company.
(x) A list of every Special Act of Parliament and Order relating to the undertaking.

V.

(1) Any local or other public authority, company, or person desiring to bring before the Board of Trade any objection to the draft Order may do so by registered letter addressed to the Secretary, Board of Trade, Great George Street, London, S.W. 1, and dispatched on or before a date to be stated in the advertisement, which shall not be earlier than thirty days after the date on which publication of the advertisement will be completed. Any such objection shall state:

(*a*) The specific grounds of objection.
(*b*) The omissions, additions, or modifications asked for.

A copy of the objection shall be forwarded to the applicants for the Order, or their agents, at the same time as it is sent to the Board of Trade.

No part of the month of August shall be included in calculating the above-mentioned period of thirty days.

(2) As soon as practicable after the period allowed for objections has expired, the applicants or their agents shall furnish the Board of Trade with their replies to any objections which have been made, and shall at the same time send a copy to the respective objectors.

VI.

The applicants, or their agents, shall prove compliance with the provisions of the foregoing rules. Six days' notice will be given of the day and hour at which they shall attend for the purpose at the office of the Board of Trade if so required.

VII.

The applicants shall furnish the Board of Trade with such information and documents as they may require in connection with the application, including

(1) Where it is proposed to use any lands for the manufacture or storage of gas or the manufacture or conversion of residual products, the deed of conveyance to, or the contract for purchase by, the applicants of all lands to be so used. [These documents will be returned to the applicants as soon as they have been inspected on behalf of the Board of Trade.]
(2) Where the applicants are a company applying for additional capital, a certified copy of a resolution, passed by three-fourths of the shareholders present and voting at a special general meeting, approving of the application, together with a certified copy of the notice convening the meeting.
(3) Where the applicants are a company and propose to purchase, or to amalgamate with, another undertaking a certified copy of a resolution passed in a similar manner approving of the application. Proof will also be required that the purchase or amalgamation is approved by the shareholders in, or owners of, the other undertaking concerned.

VIII.

The fee payable in connection with an application shall be £35, and a cheque for this amount, made payable to the Assistant Secretary for Finance, Board of Trade, should accompany the application. In addition, any extraordinary expenses incurred by the Board of Trade in connection with an inquiry into the application or otherwise shall be payable by the applicants.

IX.

In these rules the expression "the local authority" means in England, Wales, and Ireland the council of a county, county borough, and urban district, and in Scotland the county council and the town council, and the expression "road authority" means any public authority having jurisdiction over roads which it is proposed to authorize the applicants to break-up for the purposes of their undertaking.

X.

These rules may be cited as the "Gas Regulation Act (Special Orders) Rules, 1920," and shall come into operation from the date hereof.

CALORIFIC POWER AND TESTING OF GAS.

The "Caloriscope."

AT the meeting of the Southern Association of Gas Engineers and Managers yesterday week, Mr. E. V. EVANS, F.I.C., of the South Metropolitan Gas Company, was down to open a discussion on the above subject. Owing, however, to the shortness of time that remained after the discussion on sulphate of ammonia, this item had to be limited to a description of the "Caloriscope," which has been designed in the laboratories of the South Metropolitan Gas Company for rapidly determining the calorific power of gas on the works by men untrained in the use of delicate scientific instruments. The first of the instruments designed was shown; and it created a considerable amount of interest. But a simplified type of the apparatus has since been planned, as mentioned by Mr. Evans in his final remarks.

Mr. EVANS said the introduction of the thermal basis for the sale of gas in the industry had created a demand for an instrument suitable for use in maintaining control over the calorific value similar to that afforded in the case of illuminating power by the jet photometer. Such an instrument—the "Caloriscope"—he wished to bring to the notice of the members, although it was very far from being the last word in such apparatus. In designing the caloriscope, it was considered that such an instrument should be:

(1) Cheap.
(2) Capable of use by men untrained in the use of delicate scientific instruments—for example, retort-house foremen, exhauster attendants, and others.
(3) Capable of indicating changes in the thermal value of the gas.

No doubt the ideal instrument was the recording calorimeter, various types of which had already been introduced to the industry. But in all cases these were expensive, and from time to time required expert attention.

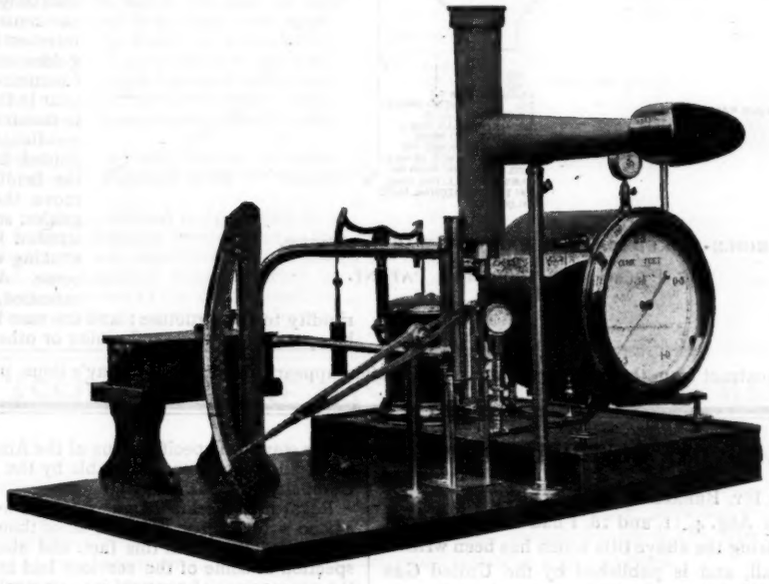
Mr. Evans expressed great diffidence in speaking about calorimeter design, knowing that the problem presented considerable scope for ingenuity, and that there was an extensive field for discovery in this connection in the future. The principle on which the "Caloriscope" was based was discovered by E. J. Brady, of Philadelphia, U.S.A., and an account was published in the "GAS JOURNAL" about a year ago.* Brady found that, when air was admitted in gradually increasing proportion to a luminous gas-flame or gas added to a non-luminous bunsen flame, a point was reached when the luminous tip in the interior of the flame just disappeared. If, at this point, the ratio of primary air to gas in the mixture supplied to the burner be ascertained, it would be found to bear a linear relationship to the calorific value of the gas. Although this relationship probably did not exist in the case of all possible combustible gases, it certainly existed for a considerable number of gases, in which cases the calorific values so determined differed from those found by a Boys' calorimeter by not more than 2 p.ct. Brady, in announcing his discovery, also published a description of an ingenious apparatus, which, however, suffered from the defects that it was intermittent in action, and did not indicate changes in the quality of gas under examination unless separate complete tests were being continuously made. It further required a certain degree of care in operation.

* See "JOURNAL," Dec. 16, 1919, p. 608.

The great difficulty experienced in the design of any recording calorimeter was due to the variation in the rate of flow of the gas resulting from a change in specific gravity. In the apparatus devised by the South Metropolitan Gas Company based on Brady's principle, advantage had been taken of the fact that in an ordinary bunsen burner the amount of air induced is dependent upon the kinetic energy of the gas issuing from the jet, and this kinetic energy could readily be shown to vary as the square root of the density of the gas, if the pressure on the jet remained constant. But the rate of discharge of the gas under similar conditions varied inversely as the square root of the density; so that, provided the pressure on the jet remained constant, the air : gas ratio did not vary with changes in the density of the gas, except in so far as the jet form was influenced by the density of the gas. In a few words, any alteration in the density of the gas is automatically corrected by a change in its inducing power.

In the apparatus demonstrated, this fact had been made use of by providing a bunsen burner with a good governor on the gas supply and a throttle in the form of a sensitive needle-valve on the air-inlet. The operation of the throttle caused the movement of a pointer over a graduated scale. Both primary and secondary air were passed over water before being supplied to the burner in order to ensure their being of the same degree of saturation as the gas. The flame was adjusted to the neutral point defined by Brady, and the degree of throttling of the air read off on the scale. By comparing a series of such results with calorific values obtained with a standard calorimeter, a relationship could be established and the scale graduated in B.Th.U.

A meter was also shown in the instrument; but Mr. Evans said it was not necessary, except for periodical verification of the gas being passed by the jet.



THE CALORISCOPE.

Experience had indicated that with the instrument a calorific value determination, accurate to within 1 or 2 p.ct., could be made in less than thirty seconds by a comparatively untrained man.

In conclusion, Mr. Evans pointed out that the apparatus shown was the one with which considerable experience had been gained by the Company, as it was the first one to be designed. Already, however, a more simple type of apparatus, based on the same principle, had been devised; and it was anticipated that the final design would be of an exceedingly simple nature.

The Suggestion-Box.

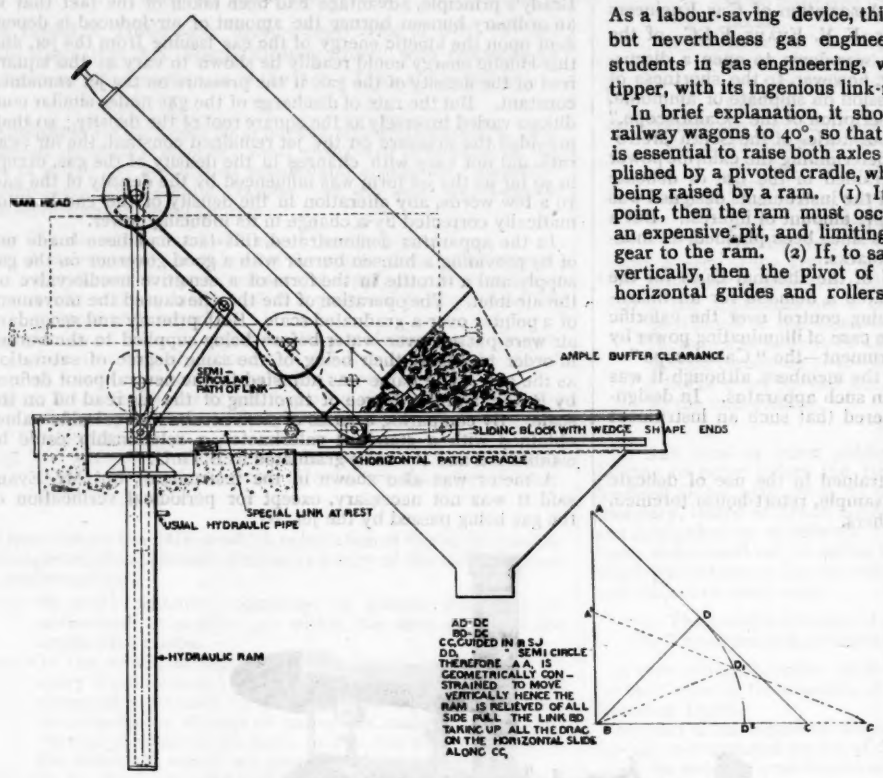
The plan of inviting suggestions from employees, which has been so often advocated, has been adopted with success by the People's Gas Company of Chicago, who pay $1 for every acceptable suggestion tending to further the Company's interests in respect of improvement of service, increased safety, reduction of expense, securing new business, &c. Each winning suggestion also becomes eligible in competition for five capital prizes awarded annually—for the best suggestion of the year $50, second best $40, third best $30, fourth best $20, and for the greatest number of suggestions accepted from any one employee during the year $10. In a period of less than eight months, more than 200 suggestions were made. The first prize of $50 in the annual award went for the adaptation of a quick-action valve-stem wrench for use in manhole and street work, which can be operated from the surface by one man. The prize for the greatest number of suggestions from any one employee went to a man who sent in twelve acceptable ideas. The competition is open to all employees except heads of departments and sub-departments, or their assistants, when suggesting improvements in their own particular work.

A NEW RAILWAY WAGON TIPPER.

The "Dempster-Toogood" Patent.

As a labour-saving device, this type of machine is well known; but nevertheless gas engineers contemplating new plant, and students in gas engineering, will be interested in this particular tipper, with its ingenious link-motion.

In brief explanation, it should be stated that, to tilt normal railway wagons to 40°, so that the buffers shall clear the rails, it is essential to raise both axles to varying heights. This is accomplished by a pivoted cradle, which engages both axles—the cradle being raised by a ram. (1) If the pivot of the cradle is a fixed point, then the ram must oscillate through an arc, necessitating an expensive pit, and limiting the choice of power transmission gear to the ram. (2) If, to save the cost of the pit, the ram lifts vertically, then the pivot of the cradle must be provided with horizontal guides and rollers. With guides and rollers, having the necessary working clearances, and being liable to be fouled by the discharged coal, the cradle and heavy truck, when fully elevated, form but a top-heavy and loosely-jointed structure.



BRIDLE-LINKED CRADLE RAILWAY-WAGON TIPPER.

THE "DEMPSTER-TOOGOOD" PATENT.

To save the cost of this pit, furnish a more rigid structure, and provide guides incapable of becoming choked, are the objects of the invention covered by patent No. 22,637. The novel link-motion consists only of a bridle-link connecting the centre of the cradle span to the intersection of the plane of the guides and the vertical ram. The function of this proportioned link-gear is that one end of the cradle is constrained to move exactly perpendicularly, while the other end is guided horizontally. In addition, the bridle-link assists the ram to move the cradle pivot along its guides, so that slides may be substituted for rollers, and thus any choking with coal is entirely overcome. Also, when the ram is fully extended, the bridle-link gives great rigidity to the structure; and the ram being now vertical, it may be operated by rack-and-pinion or other transmission gear.

[An extract from the inventors' patent specification appears elsewhere in to-day's issue, p. 526.]

A MANUAL OF GAS DISTRIBUTION.

By JOHN HY. BREARLEY, M.Inst.C.E.

IN the "JOURNAL" for Aug. 4, 11, and 18, I had the privilege of reviewing the book bearing the above title which has been written by Mr. Walton Forstall, and is published by the United Gas Improvement Contracting Company of Philadelphia, U.S.A. Mr. Forstall has been kind enough to send me his comments on the review. It is due to him that they should have equal publicity with the review; and, as they are most interesting, I append them to this prefatory note in the belief that they will be greatly appreciated by those who read the review in August.

Comments by the Editor of the Manual.

You are quite right in saying the book should have included some organization diagrams. At the time Chapter II. was written (probably about 1907) we had not reached our present position of making these diagrams and furnishing them to each of the departments affected. One reason probably for this omission was that our organization has always been so logical and simple that no diagram was really needed to enable each man to know his proper place.

I was very much interested in what you wrote about "The Personal Equation." Philadelphia has never been a strong trade union city; and in this country, gas company employees have always been about the last to become unionized. Therefore, it happens that the entire Philadelphia Gas-Works is still on a non-union basis. In the Distribution Department, this situation, combined with an intelligent treatment of our men, has resulted in our present very favourable situation, where, with a total force of 750 men, 325 men have been with us over two years; and of this number 80 have been with us over five years, and 160 over ten years. Not only is there the best of feeling between most of the rank and file and their foremen and superintendents, but also our cost reports indicate that the efficiency of our force has, if anything, slightly improved since the pre-war period—a rather exceptional condition.

You are right in believing that the saving of $100,000 mentioned in Chapter IX. is an annual one.

The foundry inspection of our cast-iron pipe is made according to the standard specifications of the American Gas Institute, with slight additions found advisable by the United Gas Improvement Company.

Regarding the life of gas-services, we have still in use about 45,000 wrought-iron services, all of them known to have been laid prior to 1898. From this fact, and also from the periodical inspection of some of the services laid in 1898, I now believe that the average age of wrought-iron or steel services, in good soil, will exceed forty years. This refers to black pipe; and at least fifteen years of this life will certainly be due to the Hickenlooper coating. We expect the galvanized piping to last longer than forty years, but only our successors will know the actual facts.

In regard to the grouping of "Equipment," the ideal condition would be to have always on the opposite page a picture of the tool described in the text. As this very rarely would be possible, there is no question in my mind that grouping of "Equipment" has many advantages, not the least being the facility that is thus afforded the beginner, of quickly obtaining a knowledge of such equipment.

I was interested in your comments about using several men in a gang as pacemakers. Since the war, because of the great decrease in building operations, our main-laying jobs have not offered the same facility for pacemakers as was true under pre-war conditions. In 1911, using the method described in the "Manual," we laid in one district approximately 100,000 feet of 6-inch pipe, at a depth to the bottom of the trench of 3 ft. 6 in., at a total cost (excluding paving) of 56 c. per foot, of which 39 c. represented the cost of the pipe and 12 c. the total labour cost. At that time the average pay of street labour was 18 c. per hour.

You say "three-wheel or chain pipe-cutters are not mentioned." You evidently overlooked the description of both wheel and chain cutters on p. 138, and the illustration of a chain cutter on p. 139. It is true that in describing the cutting of pipe on bank, on p. 237, no mention was made of a pipe-cutter, for the reason that for this work we have found the dog-chisel method the most expeditious. On p. 138, I note the use of the wheel or chain cutter for cutting the pipe in the trench.

Electrolysis was merely referred to, not only because it is a matter of no importance in Philadelphia, but more especially because the literature upon the subject is constantly growing, and reference to the sources of such literature was therefore considered sufficient.

The book is inconsistent in omitting street lighting details as belonging to gas utilization rather than to distribution; and then later, under "Appliance Work," covering much that belongs to utilization. The real justification in an American text-book for giving little space to street lighting lies in the fact that very few gas companies in this country have any street lighting; and those that do (and these are generally in the larger cities) usually sell the gas at the post to a street lighting contractor, who maintains the lights and cares for all the illumination details. While upon this subject, I will mention one point as illustrating the importance that small matters may sometimes assume. Only a few years ago I found that ignorance of a device known as an anti-freezer, and illustrated in fig. 106, had resulted for many years in much annoyance and expense to a gas company in New England, whose lamp-risers throughout their entire lengths were of ¾-in. pipe, and were subject, therefore, to much obstruction from frost during severe winters.

The book is "dangerously near being overloaded," unless it be considered along the line of an encyclopædia. Regarded as such, the 968 pages need not worry the reader, who, with the aid of the table of contents and the complete index, may always quickly find any phase of the subject in which he is interested, and need never read from cover to cover.

When I spoke of the prepayment meter as not being adapted to a sliding-scale of prices, I had in mind that with every change in the price of gas, it was necessary to change the price-wheel in every prepayment meter. A case in point has just occurred with the Consolidated Gas Company of New York, who had no sooner finished changing several hundred thousand prepayment meters from an 80 c. to a $1 rate than a new increase was granted from $1 to $1·20, and the whole performance, which was done by men paid at the rate of a dollar an hour, had to be gone over again. With this change in mind, and knowing what you undoubtedly are unaware of—that in this country the gas companies have not been allowed to charge more for gas through a prepayment meter than through an ordinary one—I rather naturally wrote "prudence counsels conservatism in the purchase of prepayment meters for any situation."

Up to date, we are still using "ebonite" washers for our meter connection work, and are very well satisfied with the results obtained.

It is hard for one who has not been abroad to appreciate how far ahead of other countries is the telephone development in the United States. Public telephones are distributed universally throughout Philadelphia, and our operating expenses would be appreciably increased, or else our service to the public would be much slower, were our fitters not able to communicate by telephone with district shops as occasion demands. Some of our men telephone in for orders several times a day. In this way we are always sure of being able promptly to take care of important leaks without having to keep idle men on call in the shop.

If you will turn again to p. 780, at the beginning of the sixth line under "Reflector Heater," you will find the two inverted commas, in addition to the single one, in front of "physiological," showing that the clause that follows was a quotation. It was taken from a committee report of the American Gas Institute.

It will be seen from the foregoing that Mr. Forstall has left no material point in the review untraversed. How greatly Mr. Forstall appreciated the review is shown by the following extracts from his personal covering letter to me:

"To one who has, as time allowed, been working year in and year out on the various parts of the book, whose completed structure varies but slightly from the lines laid down fifteen years ago, your review comes as the first discriminating criticism in all the period. During the preparation of the 'Manual,' it seemed impossible to obtain any considered judgment. . . . Now, however, the 'GAS JOURNAL'—true to its life-long tradition of thoroughness, where its readers' interests are concerned—has, through this review, given the first real inkling of how well I have succeeded in the task I set myself in 1905."

In a subsequent letter, dated Nov. 8, Mr. Forstall wrote:

"As a result of your comment in the review of the 'Manual,' that we in America were apparently not using wheel or chain cutters in the cutting of cast iron pipe, I asked one of my district superintendents to keep a record of the time actually taken in cutting pipe by the chisel method. I show this record below:

Size of Pipe.	Method.	Number of Men.	Time.
Inches.			Minutes.
16	Dog-chisel.	3	28
16	,,	3	35
16	,,	3	35
16	,,	3	25
20	,,	3	43
20	Diamond point.	1	60
20	,,	1	70
20	,,	1	65
20	Dog-chisel.	3	25
20	Diamond point.	1	58
20	Dog-chisel.	4	35
20*	,,	4	28
20	,,	4	32
30	,,	3	40

SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

ANNUAL GENERAL MEETING.

THE Annual General Meeting of the Association was held yesterday week, at the Hotel Cecil, Strand. The PRESIDENT (Mr. Charles F. Botley, of Hastings) was in the chair; and notwithstanding the atmospheric conditions, which did not assist or make more pleasant distant travelling, the attendance of members from all parts of the Association's extensive area was good.

MINUTES CONFIRMED.

On the suggestion of the PRESIDENT, the minutes of the last meeting as appearing in the "JOURNAL" were confirmed.

APOLOGIES.

The HON. SECRETARY (Mr. W. H. Bennett, of Redhill) referred to a number of apologies—forty or more—which he had received from members for non-attendance.

ELECTION OF OFFICE-BEARERS.

The PRESIDENT said the next business was the election of President for the coming year. Under the constitution of the Association, the President was elected at the annual meeting; but he did not take office until the March meeting, when, in the ordinary course of things, he delivered his Inaugural Address. It was his privilege and pleasure to propose to the members that the President for the ensuing year should be Mr. J. Wesley Whimster, of Bath; and those members who had the pleasure of knowing Mr. Whimster would agree with him (the President) that he would make an admirable President. He was afraid, however, they had a little trouble to bring him up to the scratch. He was none the worse for that. He had assured Mr. Whimster that the office held no terrors for the occupant. He came from that glorious historical city of Bath. He was associated with a Company which was one of the soundest financially that he (the President) had ever met with. The Company was selling gas of a quality which he was afraid to mention in the room—not because it was bad—at 2s. 10d. per 1000 c.ft. This fact alone ought to adorn the office of President. Therefore, he put to members the name of Mr. Whimster, as he was sure the Association would gain from his occupation of the presidential chair.

Mr. W. N. WESTLAKE (Exeter) said he had pleasure in seconding the resolution, particularly as they were recommending Mr. Whimster from the Western District of the Association. He came up for election with a double recommendation; for he came from the East, and was now resident in the West. For some years the members of the Western Division of the Association had had great pleasure in being associated with him in many matters in which they now acted together. They had been keenly interested in the way in which he had pushed the Bath undertaking; and they were rather proud of the position it held in the gas industry of the south-west of England. From the experience they had had of him the last few years, they were convinced he would make an excellent President. He would maintain the dignity of the chair, if elected; and he (Mr. Westlake) was not sure he would not succeed in enhancing it as well.

The motion was cordially passed.

Mr. WHIMSTER thanked the members sincerely for the great honour they had conferred upon him in electing him President for the ensuing year. What the President and Mr. Westlake had just said was very much exaggerated. Their President had spoken of the quality and price of gas in Bath. He should like to know what he (Mr. Whimster) had to do with that? However, with the help of the members, he should endeavour to do his best to carry on the Association at the high level at which it had been carried on by his predecessors. He hoped he should not fail in this, and that he should be able to uphold the prestige of the Association.

Mr. W. DOIG GIBB (London) proposed that Mr. J. M. Campbell, of Margate, should be the Vice-President. He felt that the proposing of this was an honour that he could almost claim, because no one in the room had had a longer or closer friendship than he had had with Mr. Campbell. They started out in what they might call the beginning of life together in the same drawing-office in Glasgow. They competed in the same technical classes; and incidentally he might say that neither Mr. Campbell nor himself monopolized either the first or second places. [Laughter.] At week-ends they had many delightful and (what was then some consideration to both of them) cheap excursions down the Clyde. The time came when their ways lay apart; and they then fought

their ways through the world. It had given him no greater pleasure in life than to trace the gradual upward movement of Mr. Campbell. He had proved his success at Margate; and he (Mr. Gibb) was quite certain he would prove equally successful as Vice-President of the Association. They hoped, when his time came to take the office of President, he would do equally well.

Mr. W. PHILLIPS (London) seconded the proposition, remarking that he also knew Mr. Campbell very well indeed, because he worked with him at Luton for three or four years, before he went to Margate. He could echo all Mr. Doig Gibb said as to Mr. Campbell's fitness for making a good Vice-President.

Mr. CAMPBELL thanked the members most sincerely for the honour they had accorded him in electing him Vice-President. He should certainly do everything possible to maintain the traditions of the office; and nothing should be wanting on his part, so far as his power would allow, to carry out the duties. He should like to thank Mr. Gibb for his kind remarks as to their early connection. There was considerable rivalry between them, probably due to Mr. Gibb being Edinburgh and himself being Glasgow. There was keen rivalry between these two cities; but he thought Glasgow took the plum. [Laughter.] He could thank Mr. Gibb for much assistance in his later years. He had taken an interest in his (Mr. Campbell's) career; and he thanked him for what he had done, and what he had said about him.

The HON. SECRETARY said the two members who retired from the General Committee next March were Mr. Campbell and Mr. H. C. Head. The Western District, at their meeting on Nov. 8, re-elected Mr. Head for three years; and in place of Mr. Campbell, Mr. P. G. G. Moon, of Bournemouth, had been elected.

Moved by Mr. C. VALON BENNETT (Rochester), seconded by Mr. D. IRVING, the Auditors (Messrs. Donaldson and Urquhart) were re-appointed.

Mr. H. C. HEAD (Winchester) said he wished to propose the re-election of Mr. W. H. Bennett as Hon. Secretary and Treasurer. When Mr. Bennett was elected last year, he thought they were all confident he was going to do the job uncommonly well; and so it had proved. When they asked him to take office, they were asking him to embark on the unknown, and now he knew there was a lot of hard work to be done. Most of it was pleasant work; and it brought him in touch with his *confrères*, which was a pleasant thing to happen to anyone. There was one fly in the ointment. This fly consisted of a few members of the Association who did not send their subscriptions with quite the promptitude that they might do. Starting from Mr. Chapman downwards, all the Hon. Secretaries had had the same difficulty. He put it to members that it was not at all fair to the Hon. Secretary to place him in the position of having to dun for money. He hoped Mr. Bennett would undertake the Secretary's work in the ensuing year, and for many years; but he hoped he would be spared unpleasant duty.

Mr. JAMES TAYLOR seconded the motion.

The PRESIDENT asked to be permitted to say that he greatly appreciated the work of Mr. Bennett. He was a most helpful colleague; and he had guided his (the President's) footsteps when he might have gone wrong. He had thrown a wonderful amount of energy into all he had done; and he congratulated his friend Mr. Whimster on having such an able Secretary to help him during his year of office. In the privileged position of President, he wished to emphasize the point as to the subscriptions. It was a great nuisance to an honorary officer to have to write time after time to individuals for their subscriptions. He hoped this would not continue to be necessary. It was forgetfulness, he believed; but it was one of those things that caused unnecessary trouble.

The motion was heartily agreed to.

Mr. BENNETT, in reply, said he was obliged to the proposer and the seconder of the resolution; and all he could say was that as Mr. Head anticipated, and as he promised him (Mr. Bennett), he found the duties of the office most pleasant. Emphasis had been laid on the question of subscriptions. Of course, when members were late in sending in their subscriptions, it caused a lot of work; and this was the part he disliked. It was unpleasant to have to keep writing, and being objectionable to one's fellow-members.

MR. SHOUBRIDGE AN HON. MEMBER.

The PRESIDENT submitted a resolution to elect Mr. S. Y. Shoubridge an honorary member of the Association. He said Mr. Shoubridge was, as the members knew, for many years Chief Engineer of the South Suburban Gas Company, and previously was in the Midlands and the North of England. He had now retired from active office. He was an old member of the Association, and one whom the members valued very much indeed, especially those who had an intimate knowledge of him. Provision was made in the rules for the election of honorary members; and Mr. Shoubridge greatly appreciated the honour it was proposed to be done to him.

Mr. W. E. PRICE (Hampton Wick) said it was unnecessary for him to say much about Mr. Shoubridge. All knew him as an old friend. He had done great work for the industry, and had now retired, and was taking a well-earned rest. Electing him as an honorary member would show their appreciation of his worth and his work for the industry.

The motion was carried with applause.

ELECTION OF NEW MEMBERS.

The HON. SECRETARY submitted the following long list of names for membership:

Mr. William Gordon Adam, of Beckton; Mr. Francis Chalmers, of St. Mary Church, Torquay; Mr. S. B. Chandler, of the South Suburban Gas Company; Mr. Charles A. W. Codgbrook, of Berkhampsted; Mr. Jasper Cook, of Fenny Stratford; Mr. R. Bryan Culbertson, of the Gas Light and Coke Company, Westminster; Mr. George Evetts, of Queen Anne's Gate, Westminster; Mr. Walter Grogono, of Beckton; Mr. Wallace W. Hammond, of Bognor; Mr. Stephen Hay, of Beckton; Mr. B. Fulford Jones, of Emsworth; Mr. Arthur Allen Lucas, of Newhaven: Mr. U. Orlando S. Nairne, of Wandsworth; Mr. E. A. Sainsbury, of Trowbridge; Mr. Edward Shortt, of Torpoint, Cornwall; Mr. Albert E. Tulk, of Highbridge; Mr. W. S. Venner, of Brentwood; Mr. T. H. Wallington, of Beckton; and Mr. T. E. White, of Saltash.

The PRESIDENT said the members would be gratified at such an excellent list of new names. It showed that the Association, particularly under the new constitution, was being greatly appreciated. He had much pleasure in moving that the gentlemen named be elected members of the Association.

Mr. R. BEYNON (Torquay) seconded the motion, which was unanimously carried.

PAPERS READ AND DISCUSSED.

Mr. ALEC G. CHEAL (Crowborough) read a paper on "Some Experiences with the Direct Recovery of Sulphate of Ammonia."

Mr. E. V. EVANS, F.I.C. (South Metropolitan Gas Company), read a paper on "The Manufacture of Neutral Sulphate of Ammonia."

The two papers (which were discussed together) are reproduced in later columns, with a report of the debate upon them.

THE CALORISCOPE.

Mr. E. V. EVANS followed by describing, by the aid of a specimen, the "Caloriscope" which has been developed in the laboratories of the South Metropolitan Gas Company. It is an instrument which is intended to render the same service for the calorific power of gas as the jet photometer did for the illuminating power—only better. A description appears on p. 511.

The PRESIDENT remarked that what was wanted was an instrument to be introduced in the manufacturing operations by which they would be capable of judging the calorific quality similarly as they were able to judge the illuminating power by the jet photometer. It seemed to him the instrument Mr. Evans had introduced to notice did fulfil this function to a marked degree. Mr. Evans would be glad after the meeting to give any further information.

VOTES OF THANKS.

Mr. W. DOIG GIBB moved a vote of thanks to the readers of the papers. He was sure the members were all gratified with the efforts of both the authors. He was very pleased Mr. Cheal had come forward from a comparatively small works, and had had the courage to give them an account of his experience there with the direct process of sulphate making. It must be remembered that Mr. Cheal had to be engineer, chemist, and probably accountant—indeed, everything within himself; and it was always more difficult to his mind for a man with such varied responsibilities to devote himself scientifically to these various problems than it was for an expert like Mr. Evans, with all the facilities he had at the works of the South Metropolitan Gas Company. Mr. Evans, of course, he had known for very many years. They were grateful to him for having come there and for explaining many things which in other hands might have been hopelessly complicated and not understandable.

Mr. T. GLOVER seconded the motion; and it was unanimously adopted.

Mr. G. M. GILL said it was his pleasant duty to propose a vote of thanks to the President. They would all agree with him that their thanks were due to the President for arranging such interesting papers for the meeting. The papers had thrown a good deal of light upon important subjects, and especially upon the question of neutral sulphate of ammonia. This was something that had got to come; and if it did not soon come, the trade of this country in sulphate of ammonia would in due course be overrun by the Germans. He thought their thanks were due to the President for being instrumental in bringing before them these papers, and also for the way he had presided over them. He always brought a cheerful personality to bear upon all these functions.

Mr. A. CADDICK (Croydon) seconded the motion, which was cordially passed.

The PRESIDENT thanked the proposer and seconder and the members generally for their kindness to him. He appreciated the good attendance that day; and he trusted their proceedings had been to individual advantage, as well as to that of the industry to which he deemed it an honour to belong.

This concluded the business proceedings; and tea was afterwards served in an adjoining room.

Masonic.—At last week's meeting of the Evening Star Lodge, No. 1719, W.Bro. Charles Clare was elected W.M. for the ensuing year, in succession to W.Bro. A. C. Beal; and W.Bro. Walter T. Dunn, P.M., L.R., was re-elected Treasurer.

MANUFACTURE OF SULPHATE OF AMMONIA.

Two Papers read at the Meeting last week of the Southern District Association of Gas Engineers and Managers.

At the Meeting of the Southern District Association of Gas Engineers and Managers yesterday week (Mr. C. F. BOTLEY, the President, in the chair) two papers were read—one dealing with the direct process of sulphate of ammonia manufacture, and the other with the neutralizing and drying of sulphate.

SOME EXPERIENCES WITH THE DIRECT RECOVERY OF SULPHATE OF AMMONIA.

By ALEC. GEORGE CHEAL, of Crowborough.

It is peculiar that the direct process of sulphate of ammonia manufacture does not seem to have made the progress that its apparent simplicity warrants. The general experience seems to be that the amount of sulphate recovered is disappointing compared with the returns from the "indirect" process; and at the same time rumours of serious trouble with the oxide in the purifiers may have deterred some who would otherwise have installed the system.

My own experiences with the process are probably unique, in that at the Crowborough Gas-Works the quantity of ammonia recovered was appalling; while at the Edenbridge works (with which I have been more or less connected for a number of years) the return is exceedingly satisfactory—the average yield over the five complete years since the plant was installed being 21·6 lbs. per ton of coal carbonized. This result, while not so high as that obtained in many medium and large works, must be regarded as very creditable when it is remembered that the works only carbonize about 800 tons of coal per annum.

It is in the comparison of the two plants, of the same type and by the same maker, that I have been able to discover some of the reasons for my own failures. The efficient condensation of the gas prior to it entering the acid washer is a point which has an important bearing upon the yield. At Crowborough we were unable to cool the gas properly, with the result that a large amount of tar-fog passed the Livesey washer, and was brought down in the acid washer. This not only gives trouble in its removal from the mother liquor before evaporation, but also greatly reduces the area of acid solution exposed to the gas—the top of the bubbler solution being covered with an oily scum which prevents active absorption of the ammonia. At Edenbridge, the condensation is adequate, and the gas is also passed through a tower scrubber filled with coke and worked dry, with the result that no tar has to be dealt with in the sulphate house.

Another apparently simple but important point is the circulation of the mother liquor. When the plant was first installed at Edenbridge, there was a good deal of difficulty owing to steam having to be raised in the boiler every time it was desired to circulate. To get over this, an additional small air-pump was erected, and connected by belt-drive with the shafting driving the exhauster. After this was completed, practically continuous circulation of the mother liquor was carried out, with the result that any stratification of the solution in the acid washer was impossible—the mother liquor entering at the bottom and leaving at the top. I may say that on one occasion when testing at Crowborough, we found the solution alkaline leaving the acid washer; while a sample drawn from the bottom of the washer tested was about 10 p.ct. free acid.

A very probable cause of the loss of ammonia is the method of working-up the sulphate solution, or perhaps it would be better described as a working-down of the acid strength. The solution with which the gas is washed is made-up to something between 6 and 10 p.ct. of free sulphuric acid; and, if a good salt is to be obtained, this must be worked-down to about ½ p.ct. before the solution is ready for evaporation. It is obvious that a very large excess of washing area must be provided if there is to be no loss of ammonia when the solution is working-down to such a low acid content, especially should the virgin liquor still be working at the same period. It seems that the washing should be carried out in two stages; but this would not only considerably increase the capital cost of the plant, it would also tend to complicate the working, and thus take away from the process one of the greatest claims made on its behalf.

A possible source of trouble with the purifiers is the temperature of the ammonia vapours delivered to the acid washer from the still when the virgin liquor is being worked-up. In the Edenbridge plant, an efficient water-cooled condenser on the "Liebig" principle was provided to deal with this; while at Crowborough, where the only condensation was crudely atmospheric, the acid washer in time becomes so hot that it was impossible to bear one's hand upon it.

I am convinced that, providing the plant is in every respect designed to deal with the maximum throughput of gas per hour, and that the gas itself is in a fit condition for treatment, the only remaining requisite for complete success is regular and constant attention. At Crowborough we were unable to comply with either of the first two mentioned, while the exceptional circumstances in our area created by the war prevented the equally important third being carried out.

At Edenbridge there has been difficulty owing to the amount of the working manager's time which is taken-up in attending to the plant; and if a detailed account were kept of the cost of this attention, I am afraid the balance of the sulphate account would come out on the wrong side. Yet if this attention be not given, the production per ton of coal would inevitably fall.

In these days, when the demand is for a high-grade salt, the quality manufactured by the direct process is a decided point in its favour. The sample before you was taken haphazard from the store at the Edenbridge Gas-Works; and the test of an average lot gives 25·16 p.ct. of ammonia, 2·2 p.ct. of moisture, and no free acid—the salt being neutral.

I have endeavoured without success to find any published results of a plant installed to deal with all the gas at a large works, as it seems that the difficulties in regard to the cost of working would in that case disappear, while the expert engineering and chemical supervision which would be available would probably find a way out of the other troubles I have mentioned.

THE MANUFACTURE OF NEUTRAL SULPHATE OF AMMONIA.

By E. V. EVANS, O.B.E., F.I.C.

At the last annual meeting of the Sulphate of Ammonia Association, emphasis was laid upon the necessity for improvement in the average quality of sulphate manufactured in this country, if the enlarged and keener competition of the future were to be faced successfully. Owners of moderate-sized plants were strongly urged to give consideration to the question of manufacturing a high-quality neutral product which could compete with the material placed upon the market by America, Germany, and Holland. At the present time, only one-twelfth of the total production of sulphate of ammonia in this country is in the form of a neutral product; and in view of the high-grade material being manufactured by our competitors, and the many disabilities which surround the use of the acid-containing product, it behoves us all to see that no stone is left unturned in investigating the manufacturing processes and the economics of production. It therefore seems to me very opportune that the Southern Association of Gas Engineers and Managers should have decided to devote one of their meetings to the consideration of the subject of the manufacture of sulphate of ammonia.

The problem of manufacturing from the ordinary gas-works sulphate of ammonia a neutral salt with specific physical properties is not such a simple one as it would at first glance appear to be. In the case of the purification of an organic product such as indigo, salicylic acid, or naphthol—products which are sold by the pound weight rather than the ton—an extra operation such as re-crystallization or distillation does not materially affect the final selling price. Considering, however, that the pre-war selling price of sulphate of ammonia was of the order of 1½d. per lb., and is now about 2d. to 2½d. per lb., there is only limited scope for the application of refinements in the process. This problem has engaged the attention of numerous chemists during the past few years. I need only mention the names of Adam, Capron, Linder, Lessing, and Sheard, to remind you of the many processes which have been devised for the production of a high-quality sulphate of an acid-free nature and a low moisture content. These processes have been based on the removal of the acid by means of washing the impure crystalline sulphate with a neutral or slightly alkaline solution of ammonium sulphate, or with water, or by mixing the crystalline sulphate with a fixed alkali or an alkaline carbonate, or by neutralizing the acid by means of ammonia gas. I do not propose to deal with the details of any of these processes, but to suggest to prospective manufacturers of neutral sulphate that they should investigate the relative merits of these processes by actually inspecting, wherever possible, the plants in operation.

I will now proceed to deal with the history of the manufacture of neutral sulphate of ammonia by the South Metropolitan Gas Company, and with the details of the process which is at present in operation.

In the years before the war, a large proportion of the sulphate of ammonia made by our Company was exported to the Continent and America—London being essentially an exporting centre. It had been our practice, therefore, to foster these markets and to maintain a close watch upon the developments of the synthetic trade of other countries. The technical success of the Haber synthetic ammonia process in Germany, and the rapid development of this process by the Badische Anilin und Soda-Fabrik, caused us no little concern; for it was evident that, starting with such pure chemical reagents as gaseous nitrogen and hydrogen, and sulphuric acid manufactured by the contact process, their final product would be of first quality. Our apprehensions were fully justified when, in 1913, we first received a sample of the German synthetic product. I have a small sample of it here. It is quite neutral, and practically free from moisture; and it will be observed that its mechanical properties as well as its colour are excellent. At the time we were manufacturing what was considered in this country to be a good salt—at least, we were operating the same process as in 1918, when the Sulphate of Ammonia Association's annual report referred to the universal praise bestowed upon the salt supplied by our Company. I do not quote

this in any boastful spirit, but rather to emphasize the fact that the German salt in 1913 was vastly superior to our product, which was considered in this country to be a high-quality salt. This fact was still further impressed upon us when we received, in common with other sulphate manufacturers, a letter from an American firm which emphasized the marked inferiority of British sulphate as compared with the German product, and proceeded to advise us that, unless immediate steps were taken to improve our product, we should awaken one day to find that we had lost the American trade that we had been endeavouring for a number of years to build up. These unfavourable comments, and the comparative inferiority of our product, stimulated us to further efforts in the direction of improving the quality of our salt.

Our first attempts to manufacture a neutral high-quality salt, which started in January, 1918, were unsuccessful, owing to the proposed processes being too complicated for economic large-scale production. One process of this order produced from ordinary gas-works sulphate a particularly pure material possessing all the required physical properties; but the installation and working costs were too high to allow us to proceed with manufacture. It will be observed, from the sample manufactured by the application of this process in a small unit, that the material appears to be very similar to the German synthetic product; and I must say that we have never been able to manufacture by subsequent processes a material with such an excellent appearance. We also tried processes which, up to 1919, had been patented; but for one reason or another we turned them down—the main reason being that the appearance of the final product compared unfavourably with the ideal we had been forced to set ourselves.

Before proceeding further to describe the process eventually adopted, which I propose to do in some detail, will you allow me to acknowledge the work of the technical staff of our Company. It will be well understood that the problem of manufacturing neutral sulphate of ammonia when undertaken by a large company is one which would occupy the attention of several members of the staff. The solution which I am about to present to you results from the collaborative effort of our technical men, prominent among whom are my two colleagues, Messrs. Parrish and Hollings. I must also not omit to include the name of the Gas Engineer and Manager of the Stafford Corporation, Mr. W. M. Valon, whose help has been very much appreciated.

The Process Described.

The process now adopted by our Company for the manufacture of neutral sulphate of ammonia provides for neutralizing the sulphate by means of condensing the vapours from the fixed ammonia still, diluting the solution of ammonia thus obtained until its strength is such that it loses practically no ammonia at the temperature at which it is used, and then washing the crystals of sulphate of ammonia in the centrifugal machine at 75° C.

The Condensing System.

The condensing system employed by us to obtain the solution of ammonia is demonstrated by fig. 1, which shows the serpentine condenser, together with the blow-pot and spraying device. The pipe A is connected direct to the ammonia still, and periodically the blow-pot B is charged with the ammonia condensate and there diluted. By the admission of compressed air or steam to the blow-pot (with the serpentine condenser out of circuit) the ammonia solution can be sprayed as required.

The sulphate plant operated by us is provided with separate stills for dealing with the free and fixed ammonia of the ammoniacal liquor, as clearly shown. It will be seen that a 2-in. pipe is taken from the gas-pipe connecting the two stills, which, in turn, is taken to the serpentine condenser placed directly above the centrifugal machine. In the case of installations operated with a single column still, the ammonia condensate is obtained from a pipe connected above the liming chamber of the still or from the top tray of the fixed still in those plants where one is furnished. The serpentine cooler described allows of an appreciable accumulation of washed liquor. Indeed, it is only necessary to shut off the ammonia pipe for 60 seconds to transfer to the blow-pot sufficient liquor to neutralize a ton of salt per hour. It is found that the condensate from the fixed still consists essentially of ammonium hydrate of fairly pure character. The purity of the condensate—that is, its freedom from sulphides, carbonates, or cyanogen compounds—is a function of the temperature to which the ammoniacal liquor is pre-heated, the efficiency of the free still, and the time contact and the effectiveness of the liming arrangements.

We find that 8 gallons of condensed ammonia solution contain 0·5 p.c. of NH_3 suffice to neutralize one centrifugal charge—viz., 6 cwt. of acid salt containing 0·4 p.c. H_2SO_4. Calculation shows that the ammonia actually used is only about 40 p.c. of that theoretically required to neutralize the sulphuric acid held by the salt. This is due to the fact that in the centrifugal basket displacement or washing as well as neutralization proceeds simultaneously. During this neutralization small quantities of ammonia do escape; but the evolution of pyridine by the decomposition of pyridine sulphate and its replacement by ammonia, is the chief source of objection. It has thus been found advisable to instal a suitable draughting device over the centrifugal machine.

Neutralizing.

The procedure of neutralizing the salt in the basket of the centrifugal machine is as follows: The salt is directly discharged from the saturator into the centrifugal machine, and is there whizzed for a period of 2 minutes at full speed for the purpose of allowing the major portion of the acid mother liquor to be removed. At this stage the speed of the machine is reduced to such a velocity that the basket is just revolving and the ammonia solution is sprayed on to the bed of the salt until the predetermined quantity —namely, 8 gallons—has been applied. Drying is then completed at the maximum speed, and the salt discharged.

Drying.

After neutralization, the salt which contains from 1 to 1·5 p.c. moisture is discharged from the centrifugal machine and conveyed to a drying tower. This next procedure is considered by us to be an essential feature of the process. Investigation has shown that the hygroscopicity of the acid sulphate is due to the free acid present; further, that if a completely neutral sulphate of ammonia be dried, it will continue to retain its physical condition, and the crystals do not subsequently cement together. Such a material when in contact with moist air certainly hardens on the surface—indeed, any salt will do this; but hardening takes place at the surface only, and does not penetrate into the mass. Thus the slightly bound crystals can be easily separated by crumbling between the fingers. The salt here exhibited, which has been taken from our ordinary store heap, will fall through the fingers like grass seed. It is essentially this physical nature that the farmer requires; so that the salt may be either strewn upon, or drilled into, the ground without presenting the objections that the acid containing material must have done. It is perfectly certain to us that although it is a distinct advantage to produce material which will not effect any rotting of the bags, yet that in itself is not

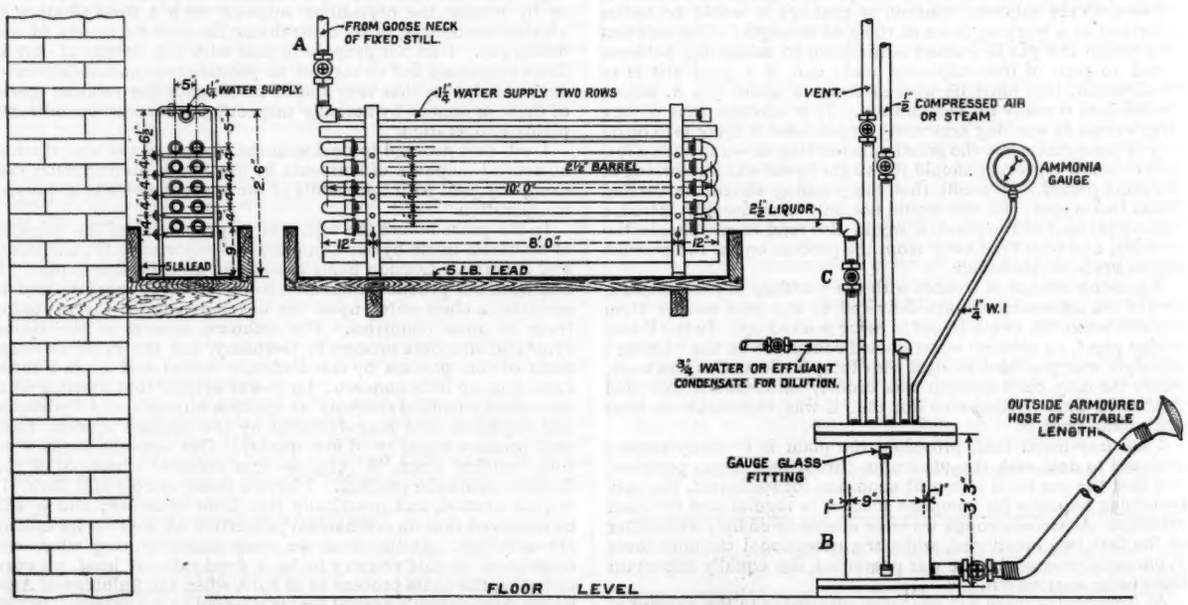


FIG. 1.—SERPENTINE CONDENSER, WITH BLOW-POT AND SPRAY.

enough—the physical nature of the product is also a factor of considerable importance.

Details of the drying tower will be easily appreciated. Drying is effected by means of heated air; the salt gravitating against the upward current of air. In the drying tower a series of baffling arrangements have been devised to aid the distribution of the salt and the elimination of water. It also shows that the baffling effect is carried out by means of hollow perforated pyramids, which act as a distributing umbrella, together with staggered triangular bars and flaps. This arrangement has been arrived at as the result of experience. The necessity for completely separating the salt at the first stage of the drying process is essential, as there is a tendency in the presence of so much liberated water vapour for the material to cling together.

The salt is fed into the tower, kept in rapid motion and obviously well distributed, and eventually collects at the base, from which it is discharged on to a travelling conveyor leading to the boot of the elevator, which, in turn, feeds the salt again to the tower. In this way a circuit is established, and the salt is maintained in circuit until the requisite degree of dryness is obtained. There is also shown the disposition of the exhauster which draws the air through the tower, as well as the disposition of the elevator and conveyor in relation to the tower. After the salt is dried in this apparatus, it is transferred to store by the conveyor, which may, at will, be directed to this purpose. As already stated, the salt leaving the centrifugal machine contains from 1 to 1·5 p.ct. of water; and the final salt is dried to a standard of 0·04 p.ct. Approximately 80 p.ct. of the water is removed in the first cycle. Several additional cycles are needed to obtain the degree of dryness required. The whole operation takes 10 to 15 minutes, depending on the moisture content of the original sulphate, the size of the crystals, and the temperature of the heated air.

It is our practice to effect the removal of moisture by means of air raised to a temperature of 150° C.; and for the purpose of heating this air a furnace has been constructed outside the sulphate building.

Quantity of Mother Liquor.

An important question, however, in considering the practicability of processes for the manufacture of neutral sulphate relates to the quantity of mother liquor produced in the process. The experience gained during the two years in which this process has been operated leads us to believe that no trouble need be anticipated from surplus mother liquor, provided the strength of sulphuric acid supplied to the sulphate of ammonia plant does not fall below 70 to 72 p.ct. H_2SO_4.

Storage, &c.

There are a number of small details in the working of the process, such as the production of a colourless salt, of well-defined crystals, &c., which could be elaborated upon; but this would result in a lengthy paper, and such matter would appear to relate generally to the manufacture of sulphate of ammonia rather than particularly to the manufacture of a neutral salt.

Finally, it is essential that the buildings in which the neutral and dry sulphate of ammonia is stored in bulk should be reasonably well ventilated, and that the drainage should be adequate and efficient.

It is interesting to remark, for the purpose of demonstrating the advantages of a neutral dry salt to the user, that the charging hoppers from which we fill our bags of sulphate gave us trouble when the first batch of neutral dry sulphate was loaded. The simple wooden slides, which were formerly quite capable of shutting-off the supply of salt, entirely failed to hold the new material, which ran through the sides of the slide almost like water, and necessitated the provision of a tightly-fitting slide.

Cost of Neutralizing.

The cost of operating the neutralizing process is 4d. per ton; while the drying process costs 11d. per ton of sulphate made.

In conclusion, will you allow me to state that, although we are in every way satisfied with the process I have described to you, I do not come to recommend for your adoption any one particular process.

DISCUSSION.

The President said he was sure the members were all much obliged to the authors of the papers for bringing forward these subjects, which were so important at the present time. There were just one or two points he would put before the meeting. He should not take very long, because he did not happen to be in a position to manufacture sulphate at the present time. He used to make it up to a little while ago; and he well remembered the difficulties he sometimes experienced with the bags after the salt had been standing a little while. He also entered into the feelings of the farmer who felt it necessary to treat their sulphate, after he received it, with sand or something of the sort. There was real need for them to look to their laurels in regard to sulphate. He asked Mr. Cheal to give them his experiences on the direct process, because as they had heard, he had had failure, and he had had success. He (the President) did wish some of the members would get into the habit of letting their colleagues into a knowledge of their failures, as well as their successes. He (the President) had acquired more knowledge by his own failures than by his successes. Therefore he felt they were indebted to Mr. Cheal for his particulars of the indirect process, because, whereas in one case he had succeeded with the process, in the other case he had had failure. The members would all probably have seen the last report of the Chief Inspector under the Alkali Works Regulation Act. If he remembered rightly, Mr. Curphey had pointed out that while the direct process was very successful in connection with coke-oven plants, it was, owing to the greater attention which was undoubtedly necessary than with the indirect system, not very popular for gas-works. Apparently, this was supported by Mr. Cheal's observations. He had seen the work at Crowborough, but not at Edenbridge. That they did make a very good sulphate was clear from the sample on the table, which, if they did not look at the samples on the other side [those exhibited by Mr. Evans], was a very good sample indeed. Mr. Cheal would be the first man to admit that it lacked some of the properties which the ideal material had. With regard to the importance of neutral sulphate, might he inflict on the members not words of his own, but some which were uttered by a very eminent gentleman—the President of the National Gas Council—in his position as Chairman of the British Sulphate of Ammonia Federation? On the point of the popularity of neutral sulphate,

> He wished to repeat once more that mechanical condition and quality were prime factors in the expansion of sales. He was pleased to be able to report that there had been considerable progress in improving the quality at many of the largest works during the past twelve

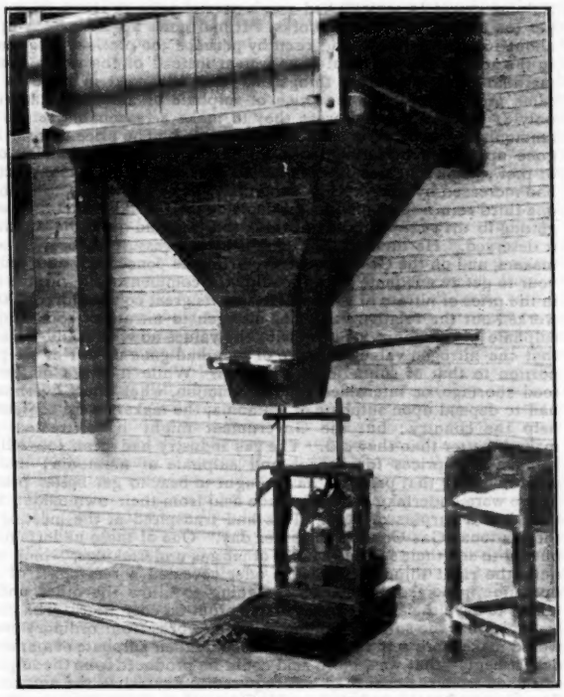


Fig. 2.

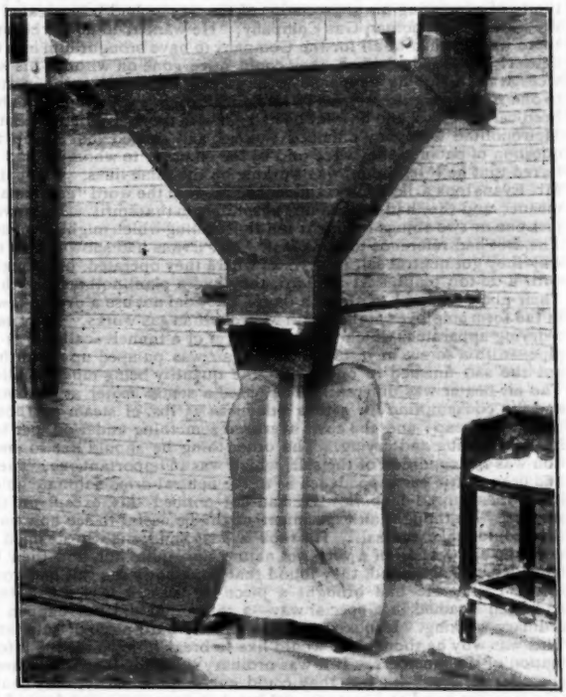


Fig. 3.

SULPHATE LOADING HOPPERS.

months. The production of neutral quality now amounted to about 30,000 tons per annum; but there was room for great improvement at the smaller works. Of course, he knew that for the very small units the alteration and adaptation of plants meant a formidable expense. But he urged the owners of moderate-sized plants, producing 1000 to 2000 tons per annum, to adopt a neutral process as soon as possible.

Might he also venture a word on behalf of the Federation which was working in the interest of sulphate of ammonia producers? It seemed rather unfair that those who benefited from the work of this body did not assist financially to carry on the work. He did ask those of the members to whom this might apply to consider seriously whether in their own interests as sulphate makers they should not join with those who were doing their best to improve the market, and upholding the best traditions of sulphate of ammonia. With regard to the paper by Mr. Evans, he should like through him once more to express their obligation to the enterprising South Metropolitan Gas Company, who had, not for the first time by any means, enabled them to have the benefit of their mature experience. Not only did they get Mr. Evans's paper at this meeting, but, as they all knew, the Company were always very pleased for other undertakings to follow what was indicated in the paper. If any of them wanted to start making neutral sulphate, this was one of the works where they could go to see how it was done. The discussion was now open. He saw before him a number of gentlemen who had a good deal of experience in the matter. One gentleman, he was reminded, was calling their attention the other day to the fact that their return for the sulphur content of coal was a decreasing quantity. Perhaps if the gentleman thought over it, he might be able to enlarge on the point. He would not mention who it was.

Mr. W. M. VALON (Stafford), invited by the President, said that first of all he should like to thank the President for inviting him to the meeting as a visitor who had had some experience with neutral sulphate of ammonia. Before doing so, he should like to take this the first opportunity of expressing his appreciation of the way he had been treated by the South Metropolitan Gas Company. He wanted to do so, because there was no need at all for the Company to have brought him into the matter. If they had liked, they could have gone on without his services at all. But he happened to be talking on Government matters to one of their engineers; and he told him of certain experiments he had been carrying out, and how far he had got with them. When the South Metropolitan Company obtained success, and started looking up the question of patents, they were told by the engineer to whom he had referred that he (Mr. Valon) was working on the same lines. Evidently, Mr. Evans took a dictionary, and looked up what the word "gentleman" meant; and they had treated him absolutely in that spirit. There were just one or two things he might tell the meeting which might be of use. The first had reference to the plant. Mr. Evans had shown them the way they got neutral salt in a works where they operated, he thought, with a 20-ton plant. At Stafford, they had a plant nothing like that. Their plant made 4½ to 5 tons a day. They did not use a drying tower in the form employed at the South Metropolitan gas-works. They used a drying apparatus, which was in the form of a tunnel—call it a 12-in. pipe—with a screw in it, in which hot air was pumped up; and they got the salt finished in one cycle—the quantity being much smaller. The air-heater was different. They used a steam-heater at Stafford; and the consumption for 5 tons a day was 35 lbs. of steam per hour. So it was cheap; and the costs averaged something under 9d. per ton for neutralizing and drying. The other thing he should like to mention was the condition of the salt, which was an important one. There had been a little correspondence as to the neutral-dried sulphate going hard when stored in bulk. He had not noticed this, except on the surface. He thought an experiment might be useful to see how hard they could make the salt. He took a heap, and slightly steamed it until the salt was all of a very wet nature and quite hot, and then he let it dry. When dried, they found that apparently the salt had gone into a rock. He had brought a piece, because it was a salt that had been steamed in a special way—a thing that did not happen in ordinary working. It looked to be an entirely hard piece of sulphate. This was why he thought he would like to break it down for the information of the members. If it was ordinary sulphate, they would need a mallet to break it; but they could cut it quite easily, they could take it in the hand and press it, and break it down into a perfectly fine powder. He did not think he could say anything that would show more conclusively that neutrally dried sulphate would go under certain conditions quite hard, but was easily broken-down. If the sulphate got wet when shipped, it would break-down quite easily at the other end; and it could be broken-down by hand. As to the user. They had now made neutral sulphate for quite a considerable time. Their farmers had been receiving nothing else for two years. A matter of eight months ago, they had a break-down; and they had to make ordinary sulphate. They sent it out in the usual way. The farmers did not order neutral sulphate. He sent 10 tons to a farmer who lived about 8 miles from Stafford. The next morning he sent it back, in his own cart, and with a bill for carriage. [Laughter.] He said it was not the sulphate to which he had been accustomed; and they had to export the material from Stafford. They found it impossible now to use any other than neutral dry sulphate. Making neutral sulphate, they would find a local sale. He was astonished at the amount of local sales they could get. They used to make 250 tons. They sold half of it; and they could now get rid of 500 tons if he was making it. The farmers would have this salt when once they had bought it. The manufacture was simple. The apparatus he had described required no extra labour. They had one man per eight hours; and the one man worked this plant just as he did when making ordinary sulphate. The cost of the plant might be interesting to them. A plant such as they had at Stafford, to make (say) 400 to 600 tons, would cost between £500 and £550, going up to 1000 tons. If they added about £50 to the cost of the plant for each extra 200 tons, they got about the figure. This was as near as he could give it offhand. They got an extra price for the salt. Making an allowance for the loss of weight in producing 25½ p.ct. sulphate, they were receiving 9s. extra per ton profit. This meant that it was an absolute business proposition to make neutral salt, even if it was not obviously necessary to make the best product.

Mr. T. GLOVER (Norwich) said he should like to congratulate Mr. Evans upon the quality of his paper, and the clear way he had given it. He (Mr. Glover) had been a sulphate maker for many years, and had always taken a great pride in the quality of his sulphate. In some works he had come across, owing to the quantity of free acid in the sulphate, the colour was bad, and the drainage was distinctly acid. They were, of course, all impressed with the importance of making neutral sulphate; and if they did not go to the trouble and expense of one of these new processes for making absolutely neutral sulphate, he thought that it was important they should strive to make good sulphate even without a special neutralizing process, such as had been demonstrated to them that afternoon. They had not, however, been told much about the extra price to set against the extra cost of manufacture. After all, it was a matter of finance. Probably they would say: "You will get no price at all if you do not make a good salt soon, because of the better German production." But there was going to be a demand for British sulphate, and British sulphate which was not specially neutralized. The manure makers, with whom they ought to keep friends, did not make any special demand for this specially neutralized sulphate. If good dry sulphate was made by the ordinary process, and it went through the mills, and mixed with other ingredients, it did not need to be of the quality which had been demonstrated to them. He admired it very much; and he quite saw if the farmers were to put it on the land direct by drills or broadcasting, it must be of this fine and dry quality. It would not do to expect the farmers to break it down on the barn-floor. If, however, they sold the sulphate to the manure mixers, they could sell them the ordinary dry sulphate. Perhaps he might be allowed to discuss the economics of sulphate making. He was strongly under the impression, owing to the work upon which he was engaged for the National Gas Council as well as on his own Company's behalf, that sulphate makers had been very badly treated by the Government in the matter of sulphuric acid, and the price of sulphate. He thought he could demonstrate this to them. Sulphuric acid (arsenical) had now a normal price of about £6 2s. 6d. per ton at the acid makers' works. It had gone up since 1913-14 by about 160 p.ct.; labour had risen by perhaps 300 p.ct.—owing partly to the adoption of the eight-hour system instead of the old-fashioned method. Bags and other things had also advanced in price in the same proportion. But the price of sulphate of ammonia had risen only 81 p.ct. Now how were they to make a reasonable return for ammoniacal products in such circumstances? The price of coal had gone up to a substantial figure. Their sulphate had risen by only 81 p.ct., while all these other materials entering into its manufacture had increased by some 200 to 300 p.ct. They were only getting about one-third return for ammonia products on their coal bill that they were getting in 1913-14. He did not think this had had quite the attention it deserved. He thought they should bring pressure to bear on acid makers, and on the Government Departments concerned, and endeavour to get an adequate price for sulphate, commensurate with the rise in the price of nitrate of soda which was its great competitor. If they worked-out the relative values of nitrogen in nitrate of soda and in sulphate of ammonia for 1913 with the values now, it would be seen that the nitrogen value of nitrate of soda had gone up out of all proportion to that of sulphate of ammonia. While it was a matter of food shortage, or intensified food production, when the Government had to depend upon sulphate of ammonia, the makers were content to help the country; but the Government might have treated the makers better than they did. The gas industry had been too willing to take low prices for benzol and sulphate of ammonia; and it was time now that pressure was brought to bear to get better prices. There were undertakings which made acid from their own oxide; and they had a surplus of acid. This had transpired at the meeting of the National Gas Council the other day. One of these undertakings offered to sell their surplus acid to other gas undertakings, which was quite the right thing to do. The offer revealed a real spirit of co-operation, provided the maker was going to allow the other undertaking to have the acid at a reasonable profit on cost price. The point was this, that the sulphur produced in gas-works from ordinary coals would make more acid than was absorbed by their sulphate of ammonia departments—that was, more acid could be produced from the sulphur extracted from the coal than was required to neutralize the ammonia. Some gas undertakings bought oxide from other works, and converted it into acid; and therefore they must have a big surplus. If the spirit of co-operation prevailed (as among gas undertakings it should prevail), then those gas undertakings would see that the works that had not acid plants of their own were provided with acid made from their own sulphur.

Dr. R. LESSING (London) said they were very much indebted to the readers of both the papers for bringing before them what was practically one subject. Mr. Cheal came before them as the representative of a small undertaking, and showed them what could be done by accurate observation; and, as had been pointed out by the President, it was not everybody who would bring before them a record of failures which were (he might almost say) in all cases worth more from the investigating point of view than successes. If he might make one remark on Mr. Cheal's paper, and then switch-over to that by Mr. Evans, he should like to say the point Mr. Cheal made as to keeping the saturator in a seething condition, if proper contact of the gases and acid was to be obtained, was a very important one, not only in connection with the direct process, but almost everywhere where a tank full of liquor was to be treated with gas and *vice versa*, and where a gas had to be broken-up. It was an experience he had had over and over again that, in a vessel like the saturator, circulation was inadequate; and they found the top layer was alkaline and the bottom layer distinctly acid. It was impossible to obtain proper ammonia extraction unless this state of affairs was remedied, and proper contact and proper mixing were obtained. Another point in the direct process—it was an important one—was the absolutely minute care in the extraction of the tar and oily matter before the gas went into the saturator. A good deal depended upon that. Mr. Cheal mentioned the scum which was formed. Unless this scum was reduced to the minimum and the tar was not permitted to accumulate in the saturator, proper results could not be obtained. He believed in this direction a good deal was to be looked for in regard to the working in "direct" plants. As to Mr. Evans's paper, he thought they were all indebted to him

for coming there that day, and submitting to them the details of the process which he and his colleagues had elaborated at the South Metropolitan Gas-Works. He was particularly struck, and he thought all present must have been, by the fairness with which Mr. Evans had mentioned the process as being the only one in a chain of a number of processes by other workers. Mr. Evans had mentioned his (Dr. Lessing's) name as having been engaged on the subject; and he thought they must all be grateful to him for the fairness with which he had put before them, and indicated the claims of, the other processes—more particularly since some of those present might not know that certain proceedings were pending in connection with the patents, into which he should not like now to go. But he might say that he could almost claim that, during the whole period during which the processes had been worked out, he had been in touch with Mr. Evans on these problems. As a matter of fact, if he told them that the first batch of neutral dried sulphate was made more than two years ago by the Company with whom he (Dr. Lessing) was connected, the members would sympathize with the "small fry" that had to work out the process by depending on the facilities and good will of others—the engineers in smaller works—to get the process established; while the big, enterprising concerns they had—such as the South Metropolitan Company—had been able to turn the whole of their very efficient staff and resources to the problem which they rightly recognized as a most important one; and they could come before them that day with an accomplished process. As Mr. Evans had pointed out to them, it would be the best thing to go to the various works and inspect what was going on; and he hoped it would not be long before the members could go and see some of the plants complete under his (Dr. Lessing's) own supervision for making the same article. He might say that the moulders' strike of ill-repute was responsible, together with a number of other conditions, for delaying the results which should have been brought before them a long time ago. As to the problem itself, he thought the fact that a neutral and dry sulphate should be put on the market by everybody, could not be sufficiently emphasized. He believed he was one of the first to suggest that neutrality in itself was not good enough, but that dry sulphate should be made. When he started on the problem over three years ago, he recognized that by neutralizing the salt only, there was nothing to be seen that farmers or any other buyers would appreciate unless they made a chemical analysis. As a matter of fact, there might be one blemish, because over-neutralization spoiled the colour—that was to say, when salt was made actually alkaline, and they precipitated the iron or other contents (which in acid solutions were almost colourless), they were likely to make a brownish salt. He recognized that it was necessary to provide the salt not only in a neutral condition, but also in a dry condition, in order to be able to obtain the advantage upon which Mr. Evans had already enlarged—viz., to get a salt which could be drilled into the soil or broadcasted with the greatest ease, quite apart from the question of acid spoiling the bags. He had brought a device with him to show what sulphate should look like, and how it ought to run. The device was in the form of a large hour-glass, and Dr. Lessing said it was the nearest approach he could get to a farmer's drill. The salt had been locked-up in the device, he believed, for nearly two years; and the salt was still in good condition. He might just say on the point of process—that was to say, neutralizing and drying—that the neutralizing could be done in any way known to the chemist for turning acid into a neutral compound, which was by adding an alkali. To neutralize sulphate of ammonia, the most obvious thing to do was to put some free ammonia in it, as was being done in the South Metropolitan process. Now a set of patents were devised by Mr. Linder which appeared to him (Dr. Lessing) to be of a very simple kind, and certainly of chemical interest, in the elegant way in which the neutrality was produced, by simply adding a small quantity of solid alkali like carbonate of soda or lime, in proportion just sufficient to obtain neutralization. Before he came to know of this, it had never occurred to him (Dr. Lessing) to treat sulphate of ammonia with lime. He should have been afraid to subject it to lime treatment. But when they came to consider it, there could be no better way of treating a few hundredweight of sulphate than with (say) 2 or 3 oz. of hydrated lime. There was just enough ammonia set free within the mass. It was not necessary to bring the lime actually in contact with the acid; but wherever it touched the sulphate of ammonia, it liberated ammonia which penetrated the whole mass; and the whole was neutralized in a few seconds almost. What had then to be done was the drying; and they actually recommended this, though it was quite open to them or to anybody to neutralize with (say) a concentrated ammonia solution which simply meant that they had to evaporate a little more water. But the lime method was the simpler one. They had heard from Mr. Valon that his arrangement was a slightly different one from that actually at work at East Greenwich; so a number of different ways could be devised in which the process could be applied. The thing was to get good drying efficiency. In his own case, they had a rotating drum into which the salt was charged. They put in the requisite quantity of lime, which could be measured out, and then run into the drum. Neutralization was done very quickly; and the hot air was blown over the sulphate to dry it. He had mentioned before the colour of the salt. If they neutralized the best salt that was free from impurities—free from mineral impurities—it would retain its colour. If they just neutralized, hardly any salt would turn colour. But if there was ever so little neutralizing agent added in excess, the colour would be changed, and the salt turned dark. He had in his office, and he should be glad to show it to anybody interested, a whole series of different samples of sulphate, every one of which was of different colour from different works. Every one was of a slightly different shade; and according to the treatment, that shade could be either just preserved or made darker. This was a point that ought to be investigated, and ought to be eliminated. If possible, one ought to put on the market a perfectly white salt in view of the competition that was bound to come from the side of the synthetic ammonia makers. This salt [showing a sample] was made in a very simple way by a method which he patented. The patent had just been published. He found that by neutralizing salt direct, the salt got darker; but all the impurities he had ever come across could be removed in an acid solution—that was to say, these colour-giving impurities were all distributed as a thin film over the original crystals in the saturator. What they knew as a rule as sulphate crystals (particularly in cases where no centrifugal was used, and the crystals were allowed to drain on the draining table), were not only original crystals made in the saturator, but those original crystals caked together by the crystalizing-out of the mother liquor which adhered to them. Therefore the lumps of sulphate did not come from the saturator. When the crystals grew together by the cooling of the mother liquor surrounding them, they got the lumps, and in the lumps they had the impurities locked up. If, on the other hand, the crystals when still free were treated by an upward current of clean mother liquor, the impurities were simply floated-off. In every case, however dirty the sulphate was, they got the original crystals in this white condition. This was not the product of recrystalization, it was the product as it came out from the saturator simply washed with an acid solution of ammonium sulphate. But it must be washed so that the particles of dirt could escape. Showing a sample, he said it was 25·72 p.ct. ammonia, free acid *nil*, and 0·05 p.ct. of moisture. Mr. Evans had mentioned the question of pyridine. He (Dr. Lessing) had found that sulphate could not be made absolutely neutral unless the whole of the pyridine was removed. In connection with work that he did seventeen years ago at the Beckton tar-works, he found out the property of pyridine, of forming an acid sulphate—that was to say, that a neutral pyridine sulphate, which would be 1 sulphuric acid and 2 pyridine molecules, was not stable. At a raised temperature, half of the pyridine was liberated, and an acid salt of pyridine remained behind. He believed this was largely responsible for the very peculiar effect on sulphate, which was always acid when they got it out of the saturator. They could not wash it out entirely unless they washed out or neutralized the acid pyridine sulphate. So long as they had a pyridine sulphate there, they could not get a properly neutral salt. He arranged his plant so that the pyridine was taken out and collected. This was in effect the point upon which he should like to have some more information from Mr. Evans. If he sprayed the sulphate in the centrifugal with his ammoniacal solution, he liberated the pyridine, and most likely also a small portion of the ammonia. And he should like to know whether these two sources of loss were accounted for, or was the excess of ammonia and pyridine simply discharged into the atmosphere. The pyridine had a most abominable smell, and would be a source of great discomfort to the workmen. He (Dr. Lessing) simply passed a current of air, after leaving the rotary drum, through a little scrubber charged with acid mother liquor, in which the pyridine was retained, and could be collected. Considering that the price of a gallon of pyridine to-day was slightly more than 20s., it would pay large and medium-sized works to extract it. A further advantage of working in a confined space as was done in his plant, apart from avoiding discomfort to the workmen, was that a centrifugal was not essential to the process, and that neutralization could be effected in the same apparatus in which the salt was being dried.

Mr. P. PARRISH (South Metropolitan Gas Company) congratulated Mr. Cheal on his paper, and on the working difficulties that had been elucidated therein. He suggested that it was wrong to assume that the direct process of ammonia recovery, as operated at a gas-works, was identical to the process as carried out at a coke-oven works. There were points of dissimilarity. Coke-oven plants had greater latitude as regards the free acid content of the saturator. Gas-works having the direct process had to work within narrower limits, lest the hydrocarbons responsible for luminosity (and incidentally the calorific value) were reacted on by the sulphuric acid. Again, most coke-oven plants were not designed to deal with the removal of sulphuretted hydrogen from the coke-oven gas leaving the semi-direct or direct saturators. Doubtless the latter two considerations were important as affecting the continued success of the direct or semi-direct process at coke-oven works. The late Chief Alkali Inspector (Mr. Curphey) had done admirable work in explaining the obscure points of the gas-works direct ammonia recovery process, and in indicating several sources of loss. Indeed, the Alkali Inspector's reports for the last few years constituted a treatise on this subject. It occurred to him (Mr. Parrish), however, that sufficient importance had not been attached to the question of entrainment. Much of the so-called condensation, which was found in the first oxide purifier at those gas-works operating the direct process was, in his view, weak acid ammonium sulphate which had been carried from the "acid bubbler" in vesicular form to the purifiers. The oxide in the latter functioned primarily as a filter or sponge, and eliminated the entrained acid ammonium sulphate. The latter acted in one or both of two ways. It decomposed the sulphide of iron, liberating sulphuretted hydrogen, and forming ammonium sulphate and ferrous sulphate; and (or) the acid ammonium sulphate reacted with the active iron oxide, forming sulphate of iron, and leaving ammonium sulphate. The "souring" of the oxide, which was common to most gas-works operating the direct ammonia recovery process, was in his (Mr. Parrish's) view due in large measure to the above cause. To restore the "soured" oxide to activity, it was found necessary to bye-pass the "acid bubbler," and allow ammonia and ammonium compounds to pass forward to the purifiers, so that the soluble iron salts formed could be precipitated as ferrous carbonate, or ferrous sulphide, with the formation of ammonium sulphate representing a further process loss. The ferrous carbonate and ferrous sulphide eventually were decomposed and oxidized respectively to active ferrous oxide. Pending the formation of the latter, the utility of the first purifier was negligible. When it was remembered that something of the order of 2 million c.ft. of crude coal gas passed the "acid bubbler" in the production of 1 ton of sulphate of ammonia by the direct method, as compared with 160,000 c.ft. of steam, hydrogen sulphide, carbonic acid, hydrocyanic acid, &c., in the ordinary sulphate of ammonia distillation process, one could form some idea of the potentialities for entrainment inherent in the direct process. Entrainment, of course, was much intensified by the spasmodic operation of the virgin liquor still, and by the increase of temperature consequent on the extra volume of ammonia and steam passing to the "acid bubbler" on such occasions. It was to be regretted that several works had abandoned, or were contemplating the abandonment of, the direct process. In his (Mr. Parrish's) view it should be possible to recover more than 22 lbs. of sulphate per ton of coal carbonized. Indeed, successful

operation of the process could be assured provided the plant was suitably modified, and additional apparatus provided. The modifications necessary were:

(1) Alteration in the design of the "absorber," to obviate stratification, and to ensure better contact between the gas and the absorbing medium.
(2) Partial dehydration of the gases leaving the virgin liquor still. (This dehydration would reduce the quantity of water reaching the "absorber" and thus secure economy in the matter of evaporation, and less possibility of entrainment).
(3) Apparatus should be provided to eliminate the viscular acid ammonia sulphate entrained; and this liquor should flow to the "absorber."
(4) Between the "absorber" and the purifiers a multitubular cooler should be interposed, to remove the water vapour, as such.
(5) As the rapid chilling, by the passage through the cooler, of the gases may create a vapour fog, a small suitable apparatus should be installed to remove such fog.

Given plant having the above modified features, and incorporating the devices named by Mr. Cheal in his paper, he (Mr. Parrish) was sanguine of the success of the direct process, and of the ability of the works to recover appreciably more than 22 lbs. of sulphate of ammonia per ton of coal carbonized, having regard to several obvious advantages, such as less possibility of the loss of ammonia by volatilization and more vigorous absorption, which the direct process ensured. Referring to Mr. Evans's excellent and lucid paper, Mr. Parrish proceeded to deal with the economic aspect of the neutral ammonium sulphate process as raised by Mr. Glover. Tabulating the figures given by Mr. Parrish on this aspect, they were as follows:

To produce one ton of ammonium sulphate with 25·5 p.ct. of ammonia requires the equivalent of $\frac{25{\cdot}5}{24{\cdot}5}$, or 1·041 ton of sulphate of ammonia of 24·5 p.ct. ammonia content.

Realization for Ordinary Sulphate of Ammonia.

	£	s.	d
1·041 ton at £25 4s. 6d. per ton =	26	5	2

Realization for Neutral Dry Ammonium Sulphate.

1 ton of neutral dry ammonium sulphate with 25·5 p.ct. ammonia equals—			
Basic price	25	4	6
Plus $\frac{25{\cdot}5 - 24{\cdot}5}{0{\cdot}25}$ = 4 (¼ units) at 5s. 6d.	1	2	0
Allowance for neutral salt	0	7	6
Allowance for drying-grinding	0	7	6
	£27	1	6

Or a gross profit of 16s. 4d. per ton, against which must be debited costs of neutralization, drying, grinding, repairs and maintenance, depreciation, and interest on capital on the additional plant. Concerning the recent suggestion that the drying of moist sulphate of ammonia was unnecessary, in that neutral ammonium sulphate absorbed moisture equally with acid sulphate of ammonia, he (Mr. Parrish) declared that the suggestion was unfounded. Indeed, Mr. Valon had ocularly demonstrated that the suggestion was untenable. It had to be remembered that atmospheric conditions might be such that actual deposition of water would occur. This deposition would vary in magnitude both with the time during which the normal conditions prevailed, and with the relative humidity of the atmosphere. Indeed, it had been found that the absorption of moisture by sulphate of ammonia was, generally speaking, closely related to the relative humidity, but that there was a material difference between the absorption of water by neutral and ordinary sulphate of ammonia. Broadly speaking, with a relative humidity of 50 to 55 p.ct., neutral salt maintained its dry and drillable character, while ordinary sulphate, as low in acid content as 0·2 p.ct. H_2SO_4, contained as much as 0·1 to 0·2 p.ct. of water, which certainly rendered the salt undrillable. The importance and necessity of drying were obvious.

The PRESIDENT said that time would not permit of carrying the discussion further. Most of them would benefit more by a consideration of what they had heard, and what the Press would put before them, than they could possibly take in now. There was certainly a point which struck him. It was that whether drying was economical or not, they would be forced to face the question. He did not think it was one that could be ignored. If they had an ideal before them, and they heard that about 25·75 p.ct. was a possible percentage of ammonia, in reaching that or some such figures they were reaching an ideal. That it required a good deal of care and trouble to produce the result was pretty evident. That it could be done for 9d. to 1s. 3d. per ton much astonished him. It was one of the things that he had learnt that day.

Mr. CHEAL, in reply, only wished to say how very gratified he was at having Dr. Lessing's confirmation on two of the main points that he had put before them in his paper—viz., the prevention of stratification, and the exclusion of any tarry or oily matters from the washers. Mr. Parrish, too, had shown that the "acid bubbler" had not approached anything like its final form for complete success.

Mr. EVANS, in reply, said, in the first instance, he wanted to thank the President and members for their kind remarks, and to say (he was sure Mr. Gill would agree with him) they would be glad to welcome gas engineers at Phœnix Wharf, East Greenwich, to see their installation. Referring to the remarks of Mr. Valon, he might say that he (Mr. Valon) was their commercial catalyst. In reply to Mr. Glover, he thought Mr. Parrish had dealt very fully with the economics of the neutral sulphate of ammonia process. He (Mr. Evans) agreed, as they were manufacturers of sulphuric acid themselves, that the price they were paying for it as manufacturers of sulphate was high. He happened to see both sides of the question, and was certain that the Sulphate of Ammonia Federation and the National Sulphuric Acid Association would be able to arrive at an equitable solution; but he did not think it would be in the direction of getting higher prices for sulphate of ammonia. Personally, with the knowledge at his disposal, he did not think the Germans would make a price for sulphate of ammonia which would suit the convenience of British makers. As to Dr. Lessing's remarks, this was the first indication he (Mr. Evans) had of any sort of proceedings pending; and he could only imagine that some appeal had been made to the Patent Office to reduce the claims the Company made in their patent specifications. Throughout the whole paper, he had not dealt with the question of priority. There were the different processes; and he was particular in the paper to recommend members to inspect very carefully the works at which the processes were being practised, and decide each one for himself which one he would prefer. The Patent Office would decide as to the validity of the patent. He complimented Dr. Lessing on his excellent latest product. It was produced by the same kind of process that his Company had had to give up owing to its being uneconomical. Probably Dr. Lessing had found some means of getting over the integral difficulties the South Metropolitan Company had encountered.

EFFECT OF BURNERS AND BARS ON HOT-PLATE EFFICIENCY.

By F. S. LARKIN, Assoc.M.Inst.Mech.E., of the Stove and Meter Department of the Gas Light and Coke Company.

[A Paper read before the London and Southern District Junior Gas Association, Nov. 26.]

I recently made a report on this matter to the Technical Committee of the Gas Sales Department of the Gas Light and Coke Company; and the Governor has consented to my laying the information before you, as I do not think that the majority of members realize the losses which occur with a large number of burners and bars. Some of the makers have brought out new types in which these defects are considerably reduced; but you must accept my remarks as applying to the majority of cooking-stoves at present in use. You will notice all through the paper that it is essentially a practical one—*i.e.*, I have not attempted to go into the matter of pure thermal efficiency to such an extent as some of the scientific members would consider necessary, but have confined myself to giving results which would, I think, be met with in district experience, and which, considered from this point of view, may be of even more use to you than if the subject were treated simply from the purely scientific standpoint.

TYPES OF BURNERS.

First of all we will consider the burner. What, from our point of view, are the qualities which a good burner should have? You can design a burner for a certain purpose, and for that it may be very satisfactory, but if used in another way the results are not all that could be desired. I should imagine that for general purposes, such as are met with in the gas-cooker, the following are the chief qualifications.

1.—It must be capable of passing enough gas in a satisfactory manner to ensure rapid boiling with economy.
2.—It must be such that, when turned down low for simmering, the heat is spread over as large a surface as possible, to prevent burning thick liquid, such as soups, stews, &c.
3.—It must be what might be termed "elastic"—*i.e.*, of a type which will not smother badly if the district pressure goes up somewhat over that for which the injector was set.

ANGLES OF BURNER DRILLING.

In the first place, as regards the angle of drilling—I have tried most of the angles, but have come to the conclusion that, for general purposes, 30° from the vertical outside and 45° inside gives the best result.

VERTICAL FLAMES.

Under expert supervision, the vertical flame has much to recommend it, as far as results go, as the efficiency appears to depend absolutely on the diameter of the circle of flame impinging on the vessel; for the nearer the centre you can impart the heat without being too local, the further have the hot gases to travel before they leave the vessel. Therefore, the vertical flame turned-down low heats over a larger area than the same volume of gas from a smaller burner in which the angle of drilling is outwards, and thus prevents local heating, though, when turned-up full, the impinging circles are identical.

The great drawback to the vertical flame is its liability to smother badly if turned slightly higher than it should be. Try putting a kettle over this type of burner, and you will see the flame draw-up to the vessel, and then, just as it touches, the whole of the outer ring seems to merge into a complete circular sheet of flame. The effect of this is that it is impossible for any secondary air to reach the inside of the ring in anything like a regular manner; for, there being no outlet through the circular sheet of flame, the products have no possibility of escape, except what come away in a series of jerks through it. Sometimes the half-burnt gases, being stronger in one direction than another, force their way through the ring, and can be seen burning outside it in a steady jet of badly-burning mixture, with the usual disagreeable smell.

The holes from which the ring of jets issue being on top of the burner, there is some slight difficulty in the secondary air getting-up round the burner to the little jets of flame; and it does not want much persuasion to go off outwards from the burner, instead of inwards to the point of combustion. When there is no vessel over the flame, the conditions are totally different, as the heat

from the burning gases produces an unimpeded current of air which keeps both the inside and outside of the jets well supplied. Now, as we move the hole from which the flame issues from its position on the top of the burner more towards the outside, the angle dropping away from the vertical, and make the pitch satisfactory—*i.e.*, the holes about ½ in. apart—it is evident that the supply of secondary air has more chance of reaching the base of its objective; and at the same time the flame, going out at an angle, gives further opportunity for the upward flow of the secondary air to mingle effectively with the escaping gas, and induces a supply to the inside of the burner. The object, then, of the angle-drilling appears to be to make the flame take such a direction that, while it gives ample chance for the secondary air to mix with it, yet does not carry the impinging circle so far out that loss occurs through the hot gases leaving the bottom of the vessel at a higher temperature than they should do.

In a burner with an inner and outer ring of holes, I place the angle of drilling in the internal ring at 45°, for the reason that it is more difficult for the secondary air to intermingle with the gas here than on the outer ring; and therefore the more horizontal the direction, provided the flames do not meet and form a baffle, the more chance there is of the proper amount of secondary air finding its way to the point of ignition. If it were practicable to have small concentric burners or groups of small burners, I should imagine that the aëration would be much better, as the secondary air would then have little difficulty in reaching the inside of the outer flame and the outside of the inner flame, which operation appears to present some difficulties in present burner construction. The following tests, will, I think, bear out the conclusions I have come to:

3-in. Burner 1¼ in. from Vessel, at 18 c.ft. per Hour.

Test in all cases: 1 quart of water raised 100° Fahr.

Holes 45° and 45°.		Holes: Outer, 30°; Inner, 45°.		Holes: Outer, Vertical; Inner, 30°.	
Meter.	Gas Used.	Meter.	Gas Used.	Meter.	Gas Used.
	c.ft.		c.ft.		c.ft.
0·00	..	2·80	..	6·30	..
1·20	1·20 Cold	3·97	1·17 Cold	7·41	1·11 Cold
1·60	..	4·40	..	7·70	..
2·74	1·14 Hot	5·51	1·11 Hot	8·73	1·03 Hot (Inclined to smother and smell.)

Holes:		c.ft.		
Outer, 10°	2·00 ..	—	Inclined to smother and smell. Outer holes too vertical.	
Inner, 45°	3·13 ..	1·13 Cold		
	3·50 ..	—		
	4·58 ..	1·08 Hot		

4-in. Ring 1½in. from Vessel, at 24 c.ft. per Hour.

As from Makers. Outer, 45°; Inner, 45°.		One Line of Holes at Alternate Angles of 30°.		Outer Holes 30° and Inner Holes 45°.	
Meter.	Gas Used.	Meter.	Gas Used.	Meter.	Gas Used.
	c.ft.		c.ft.		c.ft.
1·70	..	1·40	..	8·90	..
2·98	1·28 Cold	2·55	1·15 Cold	10·02	1·12 Cold
3·30	..	2·90	..	10·40	..
4·54	1·24 Hot	4·01	1·11 Hot (Inclined to smother and smell with increased pressure.)	11·49	1·09 Hot (These angles give a fairly elastic burner.)

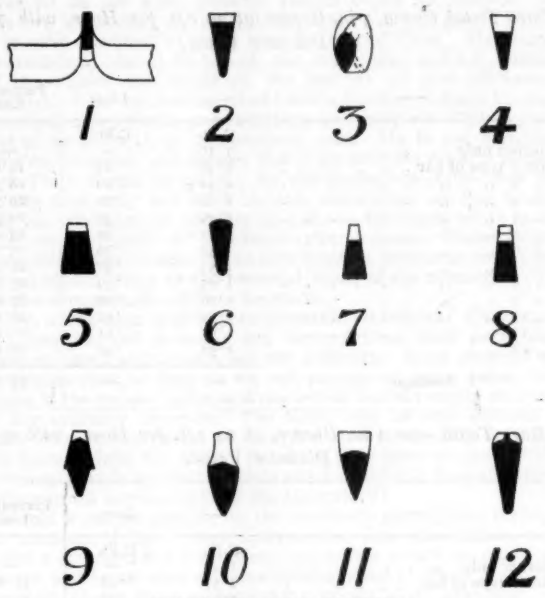
Since making the above tests, I have been able to still further improve the burner by bringing the drilling up on the outside to 20° from the vertical and on the inside 30° from the vertical. This has given a much better result—bringing the comparative figures for the 3-in. burner to 1·06 cold and 1·03 hot without any tendency to smother.

Effect of Various Forms of Bars.

In order to ascertain the exact effect of various forms of bars on the question of efficiency, I have had to make careful tests upon a number of the bars used on present-day cookers, and have selected twelve for this purpose. Though the results were in the main what was anticipated, the effect is far greater than was generally expected; the loss in one case being as high as 35 p.ct. The question of whether this was due to unsatisfactory ventilation or weight of metal in contact with the flames was one which had to be investigated, and any theory advanced proved by subsequent tests.

Burners and Vessels Used for Tests.

Owing to the absence of facilities for testing the gas in the ordinary way, you may inquire how I have managed to allocate each make to what I consider is its proper place in order of loss without testing the calorific value of the gas. What I have done is to take a test by means of a standard—in this case a good 3-in. burner at 20 c.ft. under a 7½-in. pot, and a 4-in. burner at 24 c.ft. under a 9-in. pot, on each holder of gas used—supporting the vessel over the burner by standing it on two $\frac{1}{16}$-in. diameter rods as near the edge as possible at a height of 1¼-in., and then making an allowance to the extent of the variation found in the subsequent bar test.



TYPES OF BARS TESTED.

Method of Testing.

For instance, suppose a standard test on one holder of gas showed 1·15 c.ft. for result, and the bar test 1·61 c.ft.; and on the following holder of gas the standard burner gave 1·18 c.ft., and the bar test 1·53 c.ft. I should assume that in the second test the gas was poorer by 0·03 in 1·18 c.ft.; and therefore if the second bar test had been on the first holder, the result would have been better in the proportion of $\frac{1{\cdot}15}{1{\cdot}18}$. Therefore the comparison would be 1·61 c.ft. and 1·49 c.ft., and not 1·53 c.ft.

As this method has been adopted right through, I do not think that the results will be found to be very far out. A test made on each cooker in turn gave results which could not, by any means, be used as a comparison, as the variations in the size, heights, and drilling of the burners and rates of consumption of gas and difference in bar sections gave results which were really of little value for the purpose. I therefore arranged to use the burners on a good-class stove and give methods of support so that all makes of bars could be applied to this cornice, leaving the same distance between the burner and the bottom of the vessel. The cock having been fixed at a certain rate of gas, and governed to 30-10ths pressure, by turning off the main cock each time we were as sure as we could be that all tests were identical, with the exception of the variation of the calorific value of the gas, which was allowed for in the manner described.

Very early in these experiments I was able to suggest a slight alteration to a certain maker through Mr. Fagan (the Manager of the Stove and Meter Dept.) which, by increasing the efficiency of their bars by between 5 and 7 p.ct. in itself, quite justified the time taken in carrying out these tests. I found that, by removing every alternative stud on their bars, it was possible to reduce the waste by between 5 and 6 p.ct. [The makers made it as high as 7 p.ct. in checking my results.] Consequently, all this type of cooker being delivered to us now are fitted with the new pattern bar, which considerably improves the look of the hot-plate, as well as being more economical. This improvement also could be made with some other types.

Pitch of Bars.

One difficulty was to decide as to the method of testing, owing to the pitch of the bars, as it is easily seen that, where the pitch of the bars was smaller, it would be easy to get five bars in contact with a 7½-in. kettle, while with a slightly larger pitch only four bars were in contact. Therefore, if a comparison were made in this way, the latter should show a better result than the former. I say "should," as it does not always follow that it is so, as I will explain later. Finally, it was thought best to test the bars in the same pitch as supplied by the makers, as the variation is not very great, and that is the manner in which they are designed to be used. The pitch of the bar is accounted for in the table giving the weight of metal under each size of vessel. The loss I have reduced to percentage in each case, in order that the results may be more easily seen.

Generally, you will observe that the loss from the 4-in. burner with 9-in. pot is greater than the 3-in. burner and 7½-in. pot, which goes to prove that from the point of economy the 4-in. burner at that consumption is too large for general use, even with a 9-in. vessel, as the loss in this case is getting well on towards an average of 30 p.ct.

In the case of No. 6, the result is slightly in the reverse direction. This is one of the instances I referred to when I remarked that there were exceptions to the rule that more bars under a vessel should absorb more heat than a less number. The reason for it is that under a 7½-in. pot, four bars are in contact with the

Bars Tested over a 3-in. Burner, at 20 c.ft. per Hour, with 7½-in. Diameter Vessel.

—	——	Loss.	Percentage Loss.
	C.Ft.	C.Ft.	
Burner only	1·16	—	—
No. 1 type of bar	1·38	·22	16·0
,, 2 ,, ,,	1·42	·26	18·3
,, 3 ,, ,,	1·46	·30	20·5
,, 4 ,, ,,	1·46	·30	20·5
,, 5 ,, ,,	1·51	·35	23·2
,, 6 ,, ,,	1·52	·36	23·7
,, 7 ,, ,,	1·53	·37	24·2
,, 8 ,, ,,	1·55	·39	25·1
,, 9 ,, ,,	1·56	·40	25·6
,, 10 ,, ,,	1·57	·41	26·1
,, 11 ,, ,,	1·57	·41	26·1
,, 12 ,, ,,	1·57	·41	26·1
Average	—	—	23·0

Bars Tested over 4-in. Burner, at 24 c.ft. per Hour, with 9-in. Diameter Vessel.

—	——	Loss.	Percentage Loss.
	C.Ft.	C.Ft.	
Burner only	1·29	—	—
No. 1 type of bar	1·57	·28	17·8
,, 4 ,, ,,	1·60	·31	19·4
,, 6 ,, ,,	1·66	·37	22·3
,, 3 ,, ,,	1·70	·41	24·1
,, 7 ,, ,,	1·72	·43	25·0
,, 2 ,, ,,	1·82	·53	29·1
,, 11 ,, ,,	1·85	·56	30·3
,, 8 ,, ,,	1·86	·57	30·6
,, 9 ,, ,,	1·87	·58	31·0
,, 5 ,, ,,	1·90	·61	32·1
,, 10 ,, ,,	1·94	·65	33·5
,, 12 ,, ,,	1·99	·70	35·2
Average	—	—	27·5

flames; while a 9-in. pot with one bar over the centre of the burner will be supported by five bars. In this way, the flame contact is just held in between four bars; while if one is in the centre the flame is held between five. So that all the 9-in. pot is in contact; while a proportion of the 7½-in. pot does not obtain any heat. Of course, if No. 6 bars were deep like No. 12, this would not take place, as the greater proportion of the flame would be held between three bars, and there being no ventilation the results would be very bad.

The position of No. 2 calls for remark. Under the 7½-in. pot it takes second place, while under the 9-in. it drops to the seventh. This is due to the fact that, the bars being of a wider pitch, only four come under the 7½-in. pot; while in other cases there are five. With the 9-in. pot five bars of the No. 2 are in contact, and still only five of the other makes. Therefore, the 9-in. pot test gives a result which is more reliable for comparison. Here we have the deeper bar and wider pitch affecting the result, as the flames are practically held between three bars. Hence the low position of this bar under the 9-in. vessel when compared with that under the 7½-in. one.

The results which I have submitted are satisfactory as far as they go; but what you are equally interested in is why there should be a difference of between 18 p.ct. and 36 p.ct. in the loss that occurs with different bars. There are several causes which appear to me to affect the result. The main ones I have investigated; but which is the most important is a very open question. The pitch of the bars affects the result to some extent; but the majority of makers now seem to space them out at about the same distance. Three important factors affecting the results are: (1) Ventilation. (2) Weight of metal. (3) Depth of bar.

Ventilation of Bars.

In allocating the bars in order of ventilation, I have taken the open space at the top of the bar level in a 6 in. length at right angles to the line of the bar. This is not altogether a satisfactory basis, though the results are somewhat in line with the loss shown in the actual tests already given, as we find that No. 11 bars show well in this respect. But it is made-up of a series of half circles of about ⅜-in. diameter, leaving ¼-in. of solid metal between each. Here, however, the question of skin friction of the hot gases is an important factor, as the volume which will pass through a series of half ⅜-in. circles is very small. In some other makes this area is still less, and can then almost be neglected as affecting ventilation. The following are the results in order of ventilation:

No. 1 type of bar	4·5	inches.
,, 11 ,, ,,	3·5	,,
,, 3 ,, ,,	3·25	,,
,, 7 ,, ,,	2·65	,,
,, 8 ,, ,,	2·65	,,
,, 2 ,, ,,	2·5	,,
,, 4 ,, ,,	2·5	,,
,, 10 ,, ,,	2·19	,,
,, 5 ,, ,,	2·0	,,
,, 9 ,, ,,	1·5	,,
,, 12 ,, ,,	*nil*	(practically)
,, 6 ,, ,,	*nil*	

Apart from the case of No. 11 bars previously mentioned, No. 6 is the only one calling for much comment. In this instance, it is a plain wrought-iron bar; but, being very shallow, the flames can escape under one bar near the centre and impinge upon the vessel beyond it.

Depth of Bars.

In maximum depth of bar, the following is the order:

No. 1 type of bar	0·50 inches.
,, 6 ,, ,,	0·65 ,,
,, 3 ,, ,,	0·75 ,,
,, 4 ,, ,,	0·75 ,,
,, 5 ,, ,,	0·75 ,,
,, 2 ,, ,,	0·81 ,,
,, 7 ,, ,,	0·81 ,,
,, 8 ,, ,,	0·81 ,,
,, 9 ,, ,,	0·87 ,,
,, 11 ,, ,,	1·00 ,,
,, 10 ,, ,,	1·12 ,,
,, 12 ,, ,,	1·12 ,,

Here, again, there does not appear much to comment on. No. 1 comes out best, and No. 12 worst.

Weight of Metal in Bars.

The weight of metal under the vessel has a most important bearing on the results obtained; and when we come to consider that in the case of one cooker the weight of metal is over double that of another, and also more of it in actual contact with the flame, we can only be surprised that the final efficiency is not, in this instance, considerably lower than it is.

You cannot help realizing what a tremendous loss there is in this case when, having boiled a kettle of water over the burner, you observe this mass of metal raised to a good bright-red heat, which, unless you are going to leave the kettle on there to keep hot, is absolutely wasted. Naturally, the longer the boiling is continued, the less the loss when the gas is turned-down, as the bars then will return a certain amount of heat they have absorbed. Even then, however, we must remember that they are still absorbing and transmitting heat by conduction away from the point at which it is required—viz., the point of contact with the vessel. The weight of metal in contact with the vessel I have arrived at by standing the 7½-in. pot and 9-in. pot on the bars, and cutting out and weighing the amount thus covered. The results are as follows.

7½-in. Pot.		9-in. Pot.	
No. 7 type of bar	0·95 lbs.	No. 7 type of bar	1·36 lbs.
,, 2 ,, ,,	1·00 ,,	,, 4 ,, ,,	1·44 ,,
,, 6 ,, ,,	1·01 ,,	,, 2 ,, ,,	1·44 ,,
,, 3 ,, ,,	1·03 ,,	,, 6 ,, ,,	1·47 ,,
,, 4 ,, ,,	1·05 ,,	,, 3 ,, ,,	1·58 ,,
,, 9 ,, ,,	1·23 ,,	,, 1 ,, ,,	1·64 ,,
,, 1 ,, ,,	1·25 ,,	,, 8 ,, ,,	1·80 ,,
,, 8 ,, ,,	1·28 ,,	,, 9 ,, ,,	1·94 ,,
,, 11 ,, ,,	1·66 ,,	,, 5 ,, ,,	2·28 ,,
,, 12 ,, ,,	1·67 ,,	,, 12 ,, ,,	2·36 ,,
,, 5 ,, ,,	1·84 ,,	,, 11 ,, ,,	2·39 ,,
,, 10 ,, ,,	2·01 ,,	,, 10 ,, ,,	2·98 ,,

From the above tables of relative weights you will observe at once that the No. 1, though we know it to be the most efficient, is about 25 p.ct. heavier than the No. 7. This is because in the No. 7 you have the ordinary cooker bar of light construction which is allowed to pass right through the flame, from which it must absorb heat; while in the No. 1 the heavier part of metal used for strength is kept beneath the line of flame contact, and therefore absorbs very little of the heat passing to the vessel. With the light wrought-iron bar, No. 6 again shows up very well for relative position; and when you take into account the fact that maintenance charges for breakage are practically *nil*, it has a strong claim on our consideration.

Relative Order of Merit for Types of Bars.

Now, as a matter of interest, let us try to ascertain what order those various bars would assume in efficiency if we gave them points for their respective merits in the three loss items considered. From our previous results, considering the good position held by No. 6, it looks as though depth of bar and weight of metal have a greater influence than ventilation; but we will take them all three as having an equal value, and then see what order they take in degree of loss.

No.	Ventilation.	Maximum Depth.	Weight of Metal.	Total.	Per Cent.
1	75	55	50	180	60·0
3	52	35	57	144	48·0
4	42	35	59	136	45·3
7	44	25	64	133	44·3
2	42	25	62	129	43·0
8	44	25	45	114	38·0
6	0	50	59	109	36·3
9	25	20	43	88	29·3
5	33	35	19	87	29·0
11	58	10	19	87	29·0
10	36	0	0	36	12·0
12	0	0	22	22	7·3

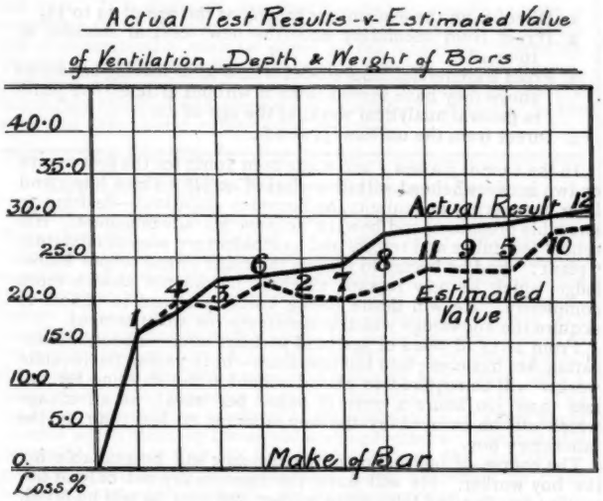
Under the heading "Ventilation," No. 1 having 4½ in. in 6 in. is credited with 75 p.ct. marks, and the others in proportion. Under "Maximum depth," No. 12 having the deepest section—1·12 in.—obtains no marks; and assuming absence of depth to be 100, by this method No. 1 obtains 55 marks, No. 2, 25, No. 11, 10, &c. With "Weight of metal," the average of weight under the 7½ in.

and 9 in. pots has been taken; No. 7 being the lightest with 1·15 lbs., and No. 10 heaviest at 2·49 lbs. Then, again, giving No. 10 no marks as being the greatest weight, and considering absence of weight as 100, we obtain values for No. 7 64 p.ct., No. 1 50 p.ct., and No. 5 19 p.ct. If these three calculated loss items are added up, we obtain the figure under the heading "Total," and, if reduced to percentage, the value under that column.

Now comes the question of comparing the results thus obtained with those found by actual test, the following being the values:

	Loss Per Cent. per Actual Test Result.		Loss Per Cent. per Points Allocated.
No. 1 type of bar	16·9	..	16·9
" 2 " " "	23·7	..	21·0
" 3 " " "	22·3	..	19·0
" 4 " " "	19·9	..	20·0
" 5 " " "	27·6	..	23·75
" 6 " " "	23·0	..	22·5
" 7 " " "	24·6	..	20·5
" 8 " " "	27·8	..	22·0
" 9 " " "	28·1	..	23·5
" 10 " " "	29·8	..	28·0
" 11 " " "	28·2	..	23·75
" 12 " " "	30·6	..	28·5

The above figures are arrived at by this method: The average of the actual test results are plotted, and No. 12, showing the greatest loss, is credited with no marks, while No. 1 has a loss of 60 p.ct. If we divide-up the vertical height between these two points into 60 parts, we can plot-out on the same chart the relative estimated values of the bars. Now reading across to the actual test result scale, we obtain the figures shown under the heading above of "Loss per cent. per points allocated." This can be easily followed from the chart.



THE QUESTION OF EFFICIENCY.

Now, just a few words in conclusion. You will, I expect, have noticed all through the paper that I have avoided referring to "efficiency," and have simply given the results of a test in loss percentage over those obtained with the burner only. I have refrained from stating the results as efficiency, as this is a term on which our scientific men differ to such an extent that it would be hopeless for a practical man to try to adopt that standard.

Take the case of the simple boiling-burner on the gas-cooker. Why should there be such a difference as we sometimes find in results arrived at by chemists of considerable repute? You get one to test a certain burner, and he gives you 45 p.ct. as the efficiency. You send it to another one as a check, and he immediately says: "Oh! the other man was all wrong. This burner gives an efficiency of 60 p.ct." Now, what chance is there for those who have to look after the practical and commercial part of the business, if our scientific advisers give us such erratic results? I do not suggest for a minute that either is faking his tests; it is only in the method of obtaining and calculating that the difference lies. Suppose we have two good men concerned—"A" and "B." "A" tests by taking a certain sized vessel and raising a quart of water from 60° to 212° Fahr. He repeats this two or three times, to make sure of the figure, and then calculates the result from the gross calorific value of the gas, and obtains his efficiency in this manner. "B," on the other hand, considers that, so long as the bars are absorbing heat, he is not obtaining the true value of the gas. He therefore makes a series of consecutive tests, the gas getting less and less until his figure is just about constant; and he concludes from this that the heat absorbed by the bars is just about counter-balanced by that radiated. He then has his quantity of water ready in another vessel at correct temperature, and pours this into the hot, but empty, vessel in which his final test is to be made, in order that he shall be heating the water only, and not the quantity of metal in the vessel as well. When he has obtained his final figure, he makes his calculation on the net calorific value of the gas, arguing that, as the net value is the utmost the consumer can obtain, the calculation should be made on this basis.

Now let us see what different results would be obtained by these two methods. "A," we will say, uses 2·0 c.ft. of 480 B.Th.U. gas to raise one quart of water from 60° to 212° Fahr. He therefore reclaims 380 B.Th.U. of the total 960 B.Th.U. used, and thus gives the result of the test as 40 p.ct. efficiency (roughly). "B," by making what I call a hot test, reduces his gas consumption to 1·6 c.ft., and therefore uses only 768 B.Th.U., instead of 960 B.Th.U. in the previous case. He is not satisfied with this, however, and decides that a net calorific value of about 430 B.Th.U. should be taken. By this method he states that he actually uses only 688 B.Th.U., and, calculating on this basis, gives his efficiency as roughly 55 p.ct.—a difference of 15 p.ct. Of course "A" and "B" represent extreme cases. There exists a possibility that results of an intermediate character might be arrived at, according to the personal ideas of the operator as to how the experiments ought to be made.

Now, which man is giving the more reliable results? Of course, both may be, and probably are, correct from their particular points of view; and therein lies the difficulty. I am strongly of the opinion that, so long as we sell our gas at gross value, the former is the correct figure, and one which can be roughly checked by any ordinary observer. The latter may be true without a doubt from certain points of view, but how misleading to those who have to face the public, to whom they have to answer for statements made by their officials which could only be maintained in the careful surroundings of the laboratory!

Would it not be possible for the makers to get together through the medium of the British Commercial Gas Association, and evolve a standard test for various apparatus which we could all rely on, and know what we were talking about? Then if we had a certain result given as (say) 50 p.ct. B.C.G.A. Standard, we should all know what to expect. I remember several years ago a certain hot-plate which was being placed on the market was said to give an efficiency of between 65 and 70 p.ct. When we came to test this paragon of virtue, however, we found only 39 to 40 p.ct. by "A's" standard; and those who had been lauding it up to the skies found themselves in a very unsatisfactory position in trying to explain the difference between the anticipated and actual results.

Again, should not time be quoted in all tests of this description? We know very well that, given a small burner and fair-sized vessel, high efficiencies can be obtained under such circumstances; but, where time is very often of as much, if not more, importance to a consumer than mere efficiency, it appears to me that one is of very little value unless the other is quoted. You may remark that, though I advocate that time should be given in all tests, I have failed to fulfil this condition in the results given. You will remember, however, that the rate of consumption was the same in all cases, and does not, therefore, affect the result; but the time can easily be calculated, if desired, from the data given.

DISCUSSION.

The paper gave rise to a long discussion, much of which had particular reference to a demonstration made by the author during the evening of the efficiency of types of hot-plate burners with which he was dealing.

The PRESIDENT (Mr. Frank J. Pearce, of the North Middlesex Gas Company) said the paper proved that Mr. Larkin had spent an immense amount of time in carrying out these detailed tests and in obtaining the results, of which he had just given them all the benefit. Of course, it was not everybody who had the opportunity of making the investigations in this manner. The author had proved to them the great importance that attached to very carefully watching how the gas-stove manufacturers turned out their cookers, more particularly with regard to burners and hot-plate bars. Mr. Larkin had shown them by actual demonstration the difference between various burners. The need for closely considering this matter was evident, when they saw that the average loss due to the placing of bars between burner and vessel was 23 p.ct. with a 3-in. burner and 27½ p.ct. with a 4-in. burner.

Mr. S. B. CHANDLER (South Suburban Gas Company) remarked that, from what Mr. Larkin had said, one could appreciate the gravity of the question with which he had been dealing; and it simply confirmed the view which he (the speaker) had long held—that the gas-cooker in a house was, from their own standpoint, one of the best appliances a gas company could put out. When the great loss occasioned by their use was considered, one felt almost inclined to ask why there should be bars at all. The heat losses by conduction were very serious; and it seemed to him that improvement was to be sought rather in the direction of eliminating the bars altogether. There were, he believed, one or two cookers on the market which followed this principle. The question was a highly important one from the point of view of the user; and certainly it was the consumer who really should be studied in the matter. He would like to ask the author whether he had had any experience with a burner that was being placed on the market, in which the ring was really eliminated, and the burner was more in the form of a mushroom valve. He himself had seen one of them in use. The bottom of the kettle was about ¼-in. off the flame; and one almost got surface combustion effect. The consumer who had had it fixed declared that with it he had saved considerable quantities of gas, running into thousands of cubic feet; and he (Mr. Chandler) noticed that the heat round the sides of the vessel was almost negligible. It seemed to him that here lay an opportunity of further increasing the efficiency of the gas-cooker. He would have liked the author to have dealt more fully with the thermal losses, which appeared to be very heavy.

Mr. H. E. G. MILLINGTON (Gas Light and Coke Company) said he would be glad to know the amount of loss in the case of the "Utility" hot-plate, and the heat losses generally in solid hot-plate stoves, if the

author had experimented with them. Also, with the "Utility" hot-plate, how long was the heat retained, in comparison with the electric cooker with a solid hot-plate.

Mr. D. J. WINSLOW (Lea Bridge District Gas Company) said the last speaker had mentioned the matter of solid hot-plates. Mr. Larkin had shown them the great loss there was in regard to heat conduction by the bars, &c. What would his idea be as to a solid top? Would there be any real advantage in this type over the ordinary bar style?

Mr. E. G. STEWART (Gas Light and Coke Company) said these experiments had given rise to many thoughts in Mr. Larkin's mind, with the result that he had designed a cooker hot-plate which was solid in the ordinary way, but could be made into a barless burner. He (the speaker) had one of these fitted-up, and had tested it; and it was giving results which were better than those of the burner to which Mr. Chandler had referred, and which he (Mr. Stewart) had also tested, and better than those of the ring-burners with which the author had just demonstrated. The efficiency in boiling an ordinary household kettle, with a respectable amount of fur, was well over 50 p.ct., taken on a snap test. Referring to the matters with which Mr. Larkin had been dealing, he might say he had found from experiment that, so far as ventilation was concerned, they could practically rule this out of court. The other two factors Mr. Larkin had mentioned—depth and weight of bar—were, however, really important. If Mr. Larkin would take his kettle and boil it, and then drop the heated-up bar into water, he would be able to account for the whole of the heat he had lost.

Mr. F. AINSWORTH (Ilford Gas Company) said the paper they had had that evening was one which ought to have been read twenty years ago. The makers of cookers were already attacking the question Mr. Larkin had dealt with; and there was no doubt the hot-plate would be very much better in future than it was at the present time. In selecting burners, it was really necessary to consider the purpose for which they were used. A burner might give excellent results for one purpose, and yet be deficient for other things; and therefore for general use they had to get somewhere between the two.

Mr. J. G. CLARK (Gas Light and Coke Company) agreed that the subject was one calling for very careful consideration. They must realize the importance of the hot-plate, as compared with the other parts of a cooker. Anything from 70 to 90 p.ct. of the gas would be used in connection with the hot-plate; and so economies at this point were more necessary than at any other part of the cooker. He was impressed with the great weight of the bars—particularly when one remembered that they had to be heated-up. When a piece of bar became visibly red, it meant a substantial amount of heat. The figures given by the author had, he believed, been arrived at with what they regarded as the maximum efficient consumption of a burner. Would the results compare equally well with lower consumptions? Having regard to the developments of the gas-stove makers during the past year or so, he was reminded of an experiment he made quite a long time ago with three Kern burners clustered together on a hot-plate, and a kettle on top. He found it possible to get the kettle right down on top of the burner without smothering the flame. He was glad the author had raised the point of gross or net values, because they often saw figures published which were founded on what seemed to be a wrong premise. Either one or the other was right; but they could not both be. If they sold gas by its gross heat value, they ought to measure its efficiency in terms of that, which was quite a sound thing to do. He hoped this would prove to be the starting-point of the universal practice of reckoning hot-plate efficiencies, &c., on gross heat value.

Mr. F. A. FROST (South Metropolitan Gas Company) inquired whether the author would expect to get the same relative results as he had shown in his demonstration with a lower pressure of gas than that which he had employed.

Mr. J. HEWETT (South Metropolitan Gas Company) referred to some experiments which he himself had carried out in a somewhat similar direction to these, although on rather different lines. There were several little things which particularly appealed to him in connection with cookers. He contended that a cooker which was tested on the works, either of the manufacturer or of the gas company itself, was undergoing what one might term a fictitious test. The place to adjust a cooker was on the consumer's premises, after it had been fixed. Some person who really thoroughly understood what he was doing should follow the fitter who put the cooker into position, and carefully regulate it. Was this done? They would soon have a standard gas; and they should standardize their apparatus.

Mr. LARKIN, in reply, said the smothering of the flame did not represent a great loss in efficiency; it was the resultant fumes which were objectionable. The mushroom burner to which reference had been made he was not particularly enamoured of. He had been disappointed in the matter of increase in efficiency by flame-contact, or as near as one could get it. That was to say, he had not secured the increased efficiency which he had anticipated. If they were going to have a burner useful for quick boiling, and turned it up to a consumption of 24 or 25 c.ft. an hour, they would be driving the flame radially away from the vessel. On the other hand, if the burner was turned-down for simmering, there would be a hot jet of flame actually in contact with the vessel; and if this contained a liquid thicker than water, it would probably quickly burn. Even with water, there would be the burning effect on the vessel. As to the question about the "utility" hot-plate, much as he should like to answer this, he hardly thought the present occasion was a suitable one for the discussion of various makes of apparatus. So long as a vertical flame was adopted, he was afraid that smothering trouble would now and then be experienced. Mr. Stewart, he knew, had been greatly interested in this paper, and had made some excellent tests. It would certainly be of value to plunge the bars into cold water, and see what heat was actually absorbed by them; but this would be carrying the matter much further than he felt justified in doing in the circumstances. It was quite true that he (Mr. Larkin) had brought out a hot-plate. He had been so astonished at what the losses really were, that he thought it time to try and devise a hot-plate which eliminated the bars. For about nine months he had one of them in use at home; and on an average week's consumption of about 800 c.ft. it saved about 100 c.ft. It was quite possible that one might get better results with smaller drilled holes, if people would wait; but they would not. What was wanted was a burner that would give rapid boiling, without too much local heating. As to whether the conditions that he had set forth would apply with the gas turned-down low, he would not like to say. He was out to boil a kettle in the quickest time. He was surprised to hear it was not the general practice to adjust consumers' cookers on the premises. In the case of the Gas Light and Coke Company, the fitter always did it; and he hoped that the majority of present-day fitters, at any rate, were beginning to realize the importance of regulation.

The author was accorded a hearty vote of thanks, on the proposition of Mr. F. E. WOODFINE (South Suburban Gas Company), seconded by Mr. S. A. CARPENTER (North Middlesex Gas Company).

TRAINING OF GAS-WORKS CHEMISTS.

By FRANK B. SMALL.

[A Paper to be read before the Manchester and District Junior Gas Association, Dec. 4.]

The full course of training of an industrial chemist will depend on the nature of the industry which he desires to enter. It must be, in essence, a training in the general principles and practice of the science of chemistry, narrowing to the special knowledge of the operations and requirements of the industry. The problem in the training of an industrial chemist is to combine theory with practice, pure chemistry with applied.

Gas chemists are derived:

1. Direct from the elementary school, at the age of 14 to 15.
2. Direct from secondary and (the new) central schools, at 16 or 18.
3. From commercial laboratories where after leaving school as above they have served (with or without articles) five years in general analytical work, at the age of 21.
4. Direct from the university, at 22.

In the case of classes 1 and 2, the keen youth for the first month or two is overwhelmed with the whirl of activity about him; and later, recovering equanimity, he becomes ambitious—desiring to know his prospects, and how to achieve his advancement. His school test-tubes and retorts and gasholders are seen as miniature "plant;" and he begins to realize the value of the school knowledge which he now regrets, mayhap, he did not absorb more completely. He will desire (being keen) to return to school to acquire the knowledge which is necessary for advancement.

From 14 to 16 years of age (and perhaps later—when the Education Act has come into full operation—to 18 years), the juvenile worker will be required to attend school in the daytime for not less than 320 hours a year (8 hours per week), an advantage which will be enjoyed by the boy labourer no less than by the laboratory boy.

The course of instruction outlined below will be available for the boy worker. He will have the opportunity not only of becoming an educated laboratory worker, but also he will be fitted, if not to direct, at least intelligently to carry out the directions of either the works or the research chemist. With an adequate staff of assistants, there is no reason why the two positions should not be combined in one person. Under a system of scholarships, combined with maintenance grants, the best of these youths (though few in number) will pass to a higher day technical school or to the University, and will thus on graduation have passed through the ideal course of works' experience already referred to, followed by the higher theoretical and technical studies.

In this connection it is to be regretted that neither the Board of Education nor Education Committees have provided for or even encouraged any outlets for the great number of juvenile workers derived directly from the Public Elementary Schools. Every encouragement should be given to these young persons to seek advancement. Much could and would be done in this direction if the directors and committees of private and public gas-works would bring some pressure to bear on national and local educational authorities, and (showing a good example) would endow scholarships with maintenance for the brightest of their workers. What a magnificent thing if but one scholarship were founded for each works!

Of classes 3 and 4, the University student, having graduated with honours, including a year spent on research work, will have all the academic training and high standard of scientific attainment and skill in research that may be required from him. His works' side will be weak, his power of dealing with men undeveloped; and his appreciation of the commercial aspects of his work will have to be achieved.

The chemist who has served in a commercial analytical laboratory, coupled with theoretical study in the laboratory of a good technical school will be perfectly suitable for the position of works' chemist. He has received a thorough grounding in general analytical chemistry; and his work will be trustworthy as he has been trained to expect law cases as the result of his analyses. He understands the commercial importance of his work which is brought home to him in sampling cargoes of raw materials.

The best man again will be he who, after some years in his

general laboratory and technical school classes, proceeds to honours graduation at the University. He would be able to start beyond the intermediate stage, and would be fitted to engage in research for two out of the four years University training.

Under the Education Act of 1918, all young persons will be required to attend continuation schools. In the first years, the education will and should be general and not vocational. A broad basis of general instruction should precede the specialized studies proper to an industry. The course of training for the industrial chemist who is not proceeding direct from the higher courses of a secondary school to a University—taken in an evening course of three evenings per week in a technical school—should cover the following:

First Year.—Elementary inorganic chemistry, theory and practical; physics; heat, and generation and properties of current electricity; mathematics, with appropriate examples derived from the two sciences.

Second Year.—The same in an advanced stage, including gravimetric and volumetric analyses and an introduction to organic chemistry.

Third Year.—Higher chemistry and physics and mathematics, including gas analysis and calorimetry; introduction to physical chemistry, colloidal chemistry, &c.

Fourth Year.—The special chemistry of a gas-works, including further physical chemistry, tar analysis, distillations, coal tar products, &c. If possible, this should be continued to a higher stage in a fifth year.

In later years, as and when opportunity occurs, the gas chemist should acquire a fair knowledge of building construction and gas engineering typical in a gas-works. This might be done in the fifth year. It is desirable, too, that the student should acquire a knowledge of at least one foreign language sufficient to enable him to understand a work or paper in the language. Probably German is still the best language for the purpose. Such a course, combined with professional work, would in my opinion make a thoroughly qualified and competent chemist—trustworthy in his work and able to give advice when required.

Stoppages in High-Pressure Mains and Services.

Writing in the "American Gas Association Monthly" for November, Mr. J. D. Shattuck, of Chester (Pa.), expresses his belief that the cause of the stoppages that occur in the mains, services, and governors of high-pressure systems originates at the gas-compressors. If the gas could be cooled after compression, before it leaves the works, in condensers of sufficient area to take out all the condensates which would fall if the gas were cooled to the ground temperature, there would be little or no trouble beyond this point. He has had a case of a governor being filled with a pitch which, upon exposure to the air, became quite hard. The most frequent trouble, however, is the appearance of a fine black powder which stops-up the services and governors. The material generally appears first in the services where the demand is greatest—particularly in those that have connected to them instantaneous water-heaters. To largely overcome this, his Company designed a strainer which can be used independently of, or in combination with, the governor. It consists simply of a casting so arranged that the gas, on entering, is able to expand and slow-up in velocity. The strainer is divided into two sections, separated by a very fine brass or copper screen. As a rule, if the strainer is cleaned once in six months, there is no complaint in the use of instantaneous water-heaters.

Desulphurizing Action of Hydrogen on Coke.

In a long article published in the "Journal of Industrial and Engineering Chemistry," Mr. Alfred R. Powell, of the Pittsburgh Experimental Station of the United States Bureau of Mines, gives details of an investigation made into the efficiency of hydrogen and gases containing hydrogen as desulphurizing agents, when passed through finished coke at high temperatures or through coal in the process of coking. He states that the effect of hydrogen on the removal of sulphur from coke is very noticeable; in most cases the majority of the sulphur being removed during a period of three hours at 1000° C. With the exception of the decrease in sulphur content, the character of the coke does not seem affected by the passage of hydrogen. The decomposition of organic sulphur to form hydrogen sulphide is very little affected below 500°, but is enormously increased from 500° to 1000°. All the desulphurizing effect of the hydrogen is due to this increased decomposition, gaseous mixtures containing hydrogen—such as coke-oven gas—are slower in their desulphurizing action, and even with a longer time of exposure would probably never give the degree of desulphurization attained by the use of pure hydrogen. Their efficiency for the removal of sulphur from coke is high, however; and the re-passing of bye-product gas through the coking mass may prove of commercial value. The original state of subdivision of the coal does not affect the desulphurization process. This is because the coal fuses between 350° and 400°, while desulphurization begins above 500°. The coke produced in coke-ovens contains less sulphur than would be accounted for by the primary coking reactions. This is due to the flow of the bye-product gas through the coking mass.

REGISTER OF PATENTS.

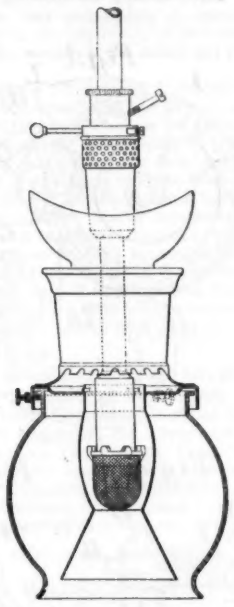
Chimneys for Inverted Incandescent Gas-Lamps. No. 144,280.

KILLING, K., of Wiesbaden, Germany.

No. 14,881; June 1, 1920. Convention date, Nov. 3, 1916.

This chimney differs from those which have become known hitherto in this respect, that, at (approximately) the level of the bottom of the incandescent mantle, it is drawn in so that its width is almost the same as that of the largest diameter of the incandescent body, and below is widened again in the manner of a funnel.

Through this formation of the chimney, it is claimed that the large quantity of fresh air that enters the funnel-like widening is positively guided towards the bottom of the incandescent body, so that at this point the combustion is "most intense." At the same time, if the enlargement is of suitable formation, the rays of light are reflected downwards from the inside of the widened part. "The result of all this is that an extraordinary increase of light is produced below."



Killing's Inverted Incandescent Gas-Lamp.

One example is illustrated; the chimney being shown in longitudinal section arranged in a lamp. Here the funnel-like enlargement is in the form of an obtuse cone; but it may differ from this, so long as it is suited for fulfilling the condition of the positive conveying of fresh air to the bottom of the incandescent body.

Railway Wagon or Truck Tipper.—No. 152,844.

TOOGOOD, H. J., and ROBERT DEMPSTER & SONS, of Elland.

No. 22,637; Sept. 15, 1919.

This invention is particularly applicable to the tipping of coal-trucks run on rails to the hopper or pit into which their contents are to be discharged.

In practice, the patentees point out, owing to the varying sizes and types of trucks and to the varying projection of the buffers, it is found that, in many cases, the buffers come in contact with the truck-rails before a sufficient inclination has been reached to enable the clear discharge of the coal to take place—especially when wet and small coal is being handled. To overcome this difficulty, a hinged cradle has been used, which, by raising the front axles slightly above the rails towards the end of the tip or discharging period, gives a clearance for the buffers. But the use of this pivoted cradle necessitates the hydraulic ram or other lifting device being likewise pivoted, which, in turn, necessitates the formation of a very large pit wherein the hydraulic ram can swing.

To reduce the expense of this pit, a further development has taken place in which the pivot of the cradle has been furnished with rollers running in top and bottom guides or between the joist flanges of the rolled steel joists which usually carry the track rails over the receptacle into which the coal is being discharged—thus allowing the ram to have only a vertical lift. Here, however, the drag of the rollers, due to the whole weight of the truck and load bearing on them, and which is aggravated by bits of coal fouling the path of the rollers, causes a considerable bending moment or side strain to be put on the ram when raised, thereby entailing its proportions being relatively massive and expensive.

The patentees propose to substitute a special application of straight-line link-gear, which will take all side pull or bending moment off the ram—thus permitting it to be reduced in its proportions, as in its governed vertical path it will support as a column the required load. The arrangement will also permit the rollers at the end of the cradle being dispensed with, and replaced by slides which cannot be fouled by coal, thereby increasing the working capacity of the coal container, or, conversely, reducing its size for a given working capacity. When

rollers are used, the container cannot be filled to its full working capacity, as when the coal gets above the level of the rails it blocks the path of the rollers; but when slides are used, they push their way through the coal without becoming jammed.

For this purpose, the cradle is pivoted to the ram and to two slide-blocks, which are free to move in two guides or rails arranged at right angles to the ram; and anchored at the point of intersection of the vertical and horizontal planes in which the ram and slides respectively move, is a link connection that is pivoted to the cradle midway between its centres, and has the same radius as half the distance between such centres. The crutch for engaging the axle may be formed on the ram, or on the cradle, and need not necessarily be in line with the ram.

[See illustrated article, *ante* p. 512.]

Controlling Illuminating Gas.—No. 151,472.

A. G. SUTHERLAND, LTD., of Birmingham, and KING, F., of Sutton Coldfield.

No. 23,839; Sept. 29, 1919.

This invention has for its purpose to provide control apparatus adapted to control automatically illuminating gas over a prolonged period.

Fig. 1.

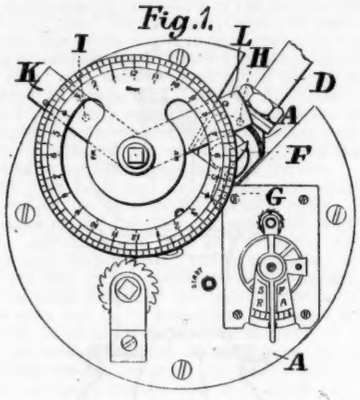


Fig 2.

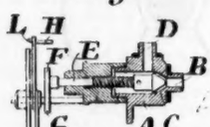


Fig. 3.

King's (A. G. Sutherland, Ltd.) Automatic Controller of Gas.

Fig. 1 illustrates in elevation clockwork mechanism operating controlling apparatus, constructed according to this invention. Fig. 2 is a reduced section of the valve, its operating mechanism, and housing. Fig. 3 diagrammatically illustrates the method of opening and closing the valve at predetermined periods.

In the embodiment of the invention shown there is a valve housing A in the nature of a horizontal cylindrical chamber, with one extremity B of which the gas supply communicates. At this extremity a conical valve seating C is provided. Extending upwardly from the chamber at right angles is the outlet D leading to the burner. A cap screwed at the extremity remote from the ingress forms a bearing for the valve stem E, which carries a conical valve member adapted to engage with the valve seating C. The stem accordingly has a quick-start screw thread—for instance, a four-start or six-start thread working within a corresponding female thread in the can. The stem passes axially through the cap, and is adapted externally to be actuated. Externally of the cap the stem is fitted with two lever arms F G, co-operating with actuating members H I, operated by clockwork mechanism J.

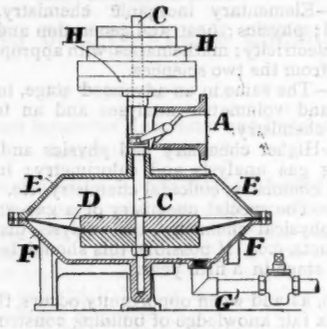
This clockwork mechanism is adapted to rotate a disc which rotates, for instance, once in 24 hours. In combination with the disc there are provided any suitable number of arms K L fixed at any predetermined positions in relation to the disc. One arm upon the rotation of the disc oscillates their valve stem in one direction—for instance, to open the valve through the medium of the parts G I, and the other engages with another arm upon the valve stem and oscillates it in a reverse direction, as, for instance, to close the valve. For this purpose the arms are furnished with the appropriately located projections H and I.

Manufacture of Water-Gas.—No. 153,051.

MEADE, A., of Blackheath, S.E.

No. 16,311; June 28, 1919.

The patentee proposes to interpose in the main steam-pipe supplying the water-gas generator a valve controlled by an automatic governor which will effect a gradual reduction in the quantity of steam supplied as the gas-making period progresses. The apparatus proposed to accomplish this consists of a cast-iron governor composed of two dish-shaped portions bolted together, and between the flanges of which is inserted a specially constructed flexible diaphragm carrying a valve-rod as shown. The special feature is the piston-like centre of the diaphragm (strengthened and stiffened by plates top and bottom) and the flexible annulus between the piston and the casing. The lower chamber is connected by means of a small pipe with the gas outlet of the generator or (say) the outlet of the scrubbers; and, consequently, the pressure in the gas outlet pipe is transmitted to the underside of the flexible diaphragm. As the gas pressure varies, so does the position of the diaphragm. For instance, when, owing to the drop in temperature of the fuel bed, the pressure falls, the diaphragm also falls, and, by means of the valve rod and link motion, the valve in the steam-pipe is partly closed, and in this way the supply of steam is checked, so that the flow corresponds with the drop in temperature of the fuel bed. The quantity of steam passing into the generator is thus regulated by the pressure on the underside of the diaphragm. The lower the pressure in the pipe serving the underside of the diaphragm, the less will be the steam passed through the valve, and *vice versa*.



Meade's Water-Gas Plant.

A preferred form of governor according to this invention is shown in sectional elevation.

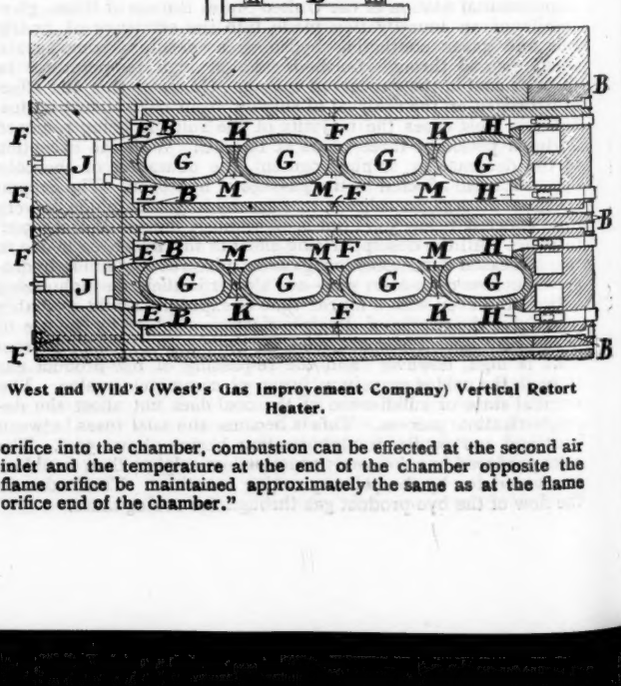
In the valve body is a butterfly valve A connected to the diaphragm D, the centre of which is stiffened by plates. The flexible annulus is held between the flanges of the top and bottom halves E and F of the casing. The upper side of the diaphragm is open to the atmosphere by way of an aperture round the valve rod C. The underside is in communication with the generator by means of the pipe G. The valve rod is loaded with weights H.

Heating of Vertical Retorts.—No. 153,139.

WEST, J., of Southport, WILD, W., of Blackpool, and WEST'S GAS IMPROVEMENT COMPANY, of Manchester.

No. 21,383; Aug. 30, 1919.

This invention comprises "the provision of two secondary air inlets to each combustion chamber at each side of the retorts—the one inlet being adjacent to the flame orifice and the other at a point between the ends of the chamber—the arrangement being such that, by reducing the amount of air passed to the gas as it issues through the flame



West and Wild's (West's Gas Improvement Company) Vertical Retort Heater.

orifice into the chamber, combustion can be effected at the second air inlet and the temperature at the end of the chamber opposite the flame orifice be maintained approximately the same as at the flame orifice end of the chamber."

The sectional elevation and sectional plan given illustrate a retort-setting arranged in accordance with the invention.

The secondary air required for combustion by each of the gas-jets in the combustion chambers A is drawn direct from the atmosphere and independently of the supplies for the remaining gas-flames. Preferably, each secondary air-supply passage B has its own control valve C—a sliding plate which extends across and through the division and outside walls D of the setting from the side opposite its flame orifice E so that the air becomes heated prior to meeting the gas. To ensure a more even distribution of the heat in the combustion chambers, there are two secondary air inlets B F at opposite sides of each row of retorts G—the one inlet B being adjacent the flame orifice E and the other approximately midway between the ends of the chamber A, so that, by reducing the amount of air admitted by the port B and passed to the gas at E as it issues into the chamber, combustion can be effected at the second air inlet F, and the temperature at the ends of the chambers opposite the flame orifices E be maintained approximately the same as at the gas-inlet end of the chamber. There is thus obtained a more uniform heating of the various retorts of a setting. The waste gases leave the chambers at the ports H. The gas burnt at the orifices E is obtained from the producer below and travels up the setting by the passages J.

The air supply for the secondary air passages F, which lead to points midway between the ends of the combustion chambers, is preferably obtained from the end of the setting at which the gas-orifices E are situated (as shown), so that the air is heated by travelling in contact with the walls of the chambers at the part where the gas-flames issue. The heat abstracted is returned to the combustion chambers at the end away from the flame orifices, and assists in equalizing the combustion chamber temperatures.

The secondary air passages B and F serve to assist the brickwork of the combustion chambers in withstanding the high temperatures usual when steaming of the retorts is practised. Further, the use of two secondary air-passages as B and F for each gas inlet E prevents local overheating adjacent to the gas-orifice.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official List" for Nov. 24.]

Nos. 32,148 to 32,828.

BELL, W. T.—"Gas-fired multitubular boiler." No. 32,597.
BRITISH DYESTUFFS CORPORATION.—"Manufacture of a chlorinated naphthalene derivative." No. 32,241.
COULSON, W. T.—"Lamps." No. 32,204.
DENNINGTON, R. C.—"Method of treating peat, &c." No. 32,600.
DENNINGTON, R. C.—"Apparatus for treating peat, &c." No. 32,601.
FOSTER, J.—"Vertical gas-retort, &c." No. 32,169.
FOSTER & PULLEN.—"Torches for lighting burners in lanterns." No. 32,265.
FRANK, G. H.—See British Dyestuffs Corporation. No. 32,241.
GIBBONS BROS.—"Continuous annealing-furnaces." No. 32,767.
GIBSON, W.—See British Dyestuffs Corporation. No. 32,241.
GILL, A.—See Foster & Pullen. No. 32,265.
LUMDÉN, H. L. R.—"Production of pure nitrogen." Nos. 32,360 and 32,361.
MARLE, M. VAN.—See Gibbons Bros. No. 32,767.
PARR, C. E.—"Desulphurizing hydrocarbons, &c." No. 32,195.
PEARSON, R.—See Parr, C. E. No. 32,195.
PERRY, W. P.—See Dennington, R. C. Nos. 32,600 and 32,601.
ROBINSON, R.—See British Dyestuffs Corporation. No. 32,241.
SMITH, H. Y.—"Gas-lighter." No. 32,198.
THORSSELL, C. T.—See Lumdén, H. L. R. Nos. 32,360 and 32,361.
WELLS, J.—See Bell, W. T. No. 32,597.
WILSON, H. J.—"Distillation of fuels, shales, &c." No. 32,458.
WILSON, J. L.—"Distillation of tar and oils." No. 32,391.

LEGAL INTELLIGENCE.

Proposed Sale of the Cowdenbeath Gas-Works.

In the Court of Session, Edinburgh, before Lord Sands, judgment was given on preliminary pleas in an action by the Cowdenbeath Gas Company against the Cowdenbeath Town Council, for declarator that a contract for the sale to the defenders of the pursuer's undertaking, as at April 30, 1915, was not binding on the pursuers. Up to the date of raising the action, there had been no actual transfer of the Company's works to the Council, nor had an arbitration been instituted for the purpose of ascertaining the purchase price. The Company held that the contract is no longer binding, because of the delay and change of circumstances. They aver that the value of the undertaking has largely increased since 1915 through capital expenditure (which, owing to the defenders' delay, they were obliged to make) having greatly altered the character of the undertaking, irrespective of the change in monetary values. If the works were now transferred to the Council, they would be getting an undertaking different from that which was the subject of the contract. Lord Sands has allowed proof before answer. He thought it desirable, before adjudicating, to have the facts—particularly as to the alleged expansion of the undertaking, and how far this expansion was forced upon the Company by the Council's delay, whether enforced or otherwise, in carrying out the contract.

Chapel-en-le-Frith Gas Company.—The report of the Chapel-en-le-Frith, Whaley Bridge, and Chinley Gas Company for the year ended September, shows a profit of £2581, to which has to be added £2331 brought forward; so that there is a disposable balance of £4502. The Directors state that, since the last report, there has been a further increase in the price of gas, with the result that the authorized dividend payable is reduced to 2½ p.ct. They are making application to the Board of Trade for an Order to enable them to pay 3¾ p.ct.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

Gas-Mantle Imports.

Sir JAMES REMNANT asked the President of the Board of Trade whether his attention had been called to the enormous increase in the import of incandescent gas-mantles during the present year in contrast with the almost negligible volume of imports of this article last year; whether the value of these imports during the period from Jan. 1 to Nov. 6 was £136,000—being an increase at the rate of 500 p.ct. upon last year; whether the proportion of the cost of production expended directly and indirectly upon wages exceeded 85 p.ct. and, therefore, during the present year involved a loss of over £100,000 to British workers; and what action he proposed to take to safeguard this important key industry from unfair foreign competition.

Sir ROBERT HORNE replied that the figures given regarding the value of imports of gas-mantles agreed substantially with the Customs statistics. He was, however, unable to accept the estimate of the proportion of production costs represented by labour, or the estimate of the loss in wages due to imports. In regard to the last part of the question, the Government had undertaken to introduce legislation dealing with key industries at the beginning of next session.

Sir J. REMNANT asked Sir Robert if he could tell them the proportion of wages paid.

Sir ROBERT HORNE said, in his opinion, it would be, not 85 p.ct., as stated in the question, but something like 50 p.ct.

Sir J. REMNANT asked Sir Robert whether he was aware that one of the largest imports of gas-mantles, amounting in value to £3936, was entered in the Customs Office during the first week of the present month, and that some of the imports of these mantles were coming through in boxes which did not clearly indicate their foreign origin; and when the existing Merchandise Marks Acts would be amended in accordance with the recommendations contained in the report of the Merchandise Marks Committee recently appointed by him.

Sir ROBERT HORNE said he was aware of the facts stated in the first part of the question. With regard to the second part, he was afraid he could not at the moment give a date for the introduction of legislation to amend the Merchandise Marks Acts; but it would be as soon as possible next session.

Public Utility Companies (Capital Issues) Act.

Copies were presented of reports of applications to the Board of Trade under the Public Utility Companies (Capital Issues) Act, by the Warminster Gas and Coke Company, the Plymouth and Stonehouse Gas Light and Coke Company, the Woking District Gas Company, the Broadstairs Gas Company, the Wisbech Lighting Company, the Lea Bridge District Gas Company, the Southgate and District Gas Company, the Bishop's Stortford, Harlow, and Epping Gas and Electricity Company, and the Sheringham Gas and Water Company.

NOTICES GIVEN FOR BILLS (SESSION 1921) RELATING TO GAS SUPPLY.

[Continued from p. 461.]

Batley Corporation.—A General Powers Bill of which notice is given by the Batley Corporation will contain various clauses to regulate the supply of gas. These are to empower the Corporation to deal in engines, stoves, ranges, pipes, and other gas-fittings; to enter premises for removing pipes and fittings; to supply buildings in private streets; to define the Corporation's obligations in regard to the supply of gas for purposes other than lighting or domestic use; to enable them to make special provisions as to terms for the supply of gas to consumers having a separate supply of either gas or electricity; to authorize them to take or supply gas in bulk; and to empower them to make, produce, or buy gas not complying with the requirements as to illuminating or calorific value, purity, or pressure prescribed by their Acts, and to supply such gas by agreement within their limits for the supply of gas for any purpose other than lighting. Other clauses will regulate the sale of coke by weight.

Burnley Corporation.—One of the objects of a Bill of which the Burnley Corporation have given notice is to authorize them to purchase or acquire offices, show-rooms, and other buildings, for the purposes of the gas undertaking, and to fit-up and maintain them.

Cardiff Gas Company.—A Bill is to be promoted by the Cardiff Gas Light and Coke Company, to enable them to substitute for the existing provisions for the sale of gas by cubic measurement a method of charging based upon the thermal units in the gas supplied; to prescribe standard or basic prices per therm, including differential prices in various parts of the Company's limits of supply; to fix standard or basic rates of dividend on existing and new capital; to provide for the application of profits in excess of the basic rates of dividend in the event of a reduction of the selling prices of gas below the basic prices; and to define and provide for the appropriation of the results of good working of the undertaking between the gas consumers on the one hand and the shareholders and employee co-partners on the other. The Company will seek further capital and borrowing powers; authority to establish a special purposes fund and acquire for the objects of the undertaking land scheduled; and an extension of their area so as to enable them to supply gas within the parishes of Caerau and Michaelstone-le-Pit, St. Andrews Major, Sully, and Michaelstone-super-Ely, in the rural district of Llandaff, and Dinas Powis, in the county of Glamorgan. This last-named clause will require the repeal of so much of the Barry Urban District Council Act of 1913 as authorizes the Council to supply gas in the parishes of St. Andrews Major and Sully. The Company will ask to be empowered, notwithstanding an agreement with the Corporation dated 1907, to increase the price of gas for public lighting; to manufac-

ture and supply power gas, and lay mains for this purpose; and to supply coke-oven gas, and gas in bulk.

Hoylake and West Kirby Urban District Council.—Application is to be made by the Urban District Council of Hoylake and West Kirby for an Act to empower them to acquire the undertaking of the Hoylake and West Kirby Gas and Water Company, Ltd., and to carry on the business. The proposed provisions include the substitution of a calorific standard for the illuminating power standard, varying prices of gas in the several parts of the area and according to the purposes for which the gas is used, exemption from obligation to supply when the capacity of the mains is insufficient, special terms to consumers having a separate supply of gas, the supply of gas in bulk, and power to make or buy and supply gas of any description, and to borrow money for the carrying into effect of the scheme.

Nelson Corporation.—The notice of a General Bill to be promoted by the Nelson Corporation states that, among other things, it is "to make provision for the consolidation of the rates levied in the borough and for levying the borough rate on all hereditaments comprised therein, for the collection of rates so consolidated, and for payment of the proceeds thereof and the revenues of the Corporation, including the revenues from their several undertakings, into one fund."

Radcliffe and District Joint Gas Board.—Application is intended to be made by the Urban District Councils of Radcliffe, Prestwich, Whitefield, and Little Lever for an Act to constitute and incorporate a Joint Gas Board, for the purpose of acquiring the undertaking of the Radcliffe and Pilkington Gas Company, and of supplying gas within the limits for the supply of gas by the Company and elsewhere. It is intended particularly to authorize the Board to supply gas in the urban districts of Radcliffe, Prestwich, Whitefield, and Little Lever, the parishes of Ainsworth, Outwood, and Unsworth in the rural district of Bury, and Heaton Park in the City of Manchester, whether the whole of such districts, parishes, and places are, or are not, included within the Company's limits. The Board wish for exemption from the obligation to supply gas when the capacity of the mains is insufficient, and to make provision for the removal of fittings and the expenses of re-connecting the supply after a discontinuance to be paid by the consumer; to prescribe the terms upon which a supply may be afforded where the consumer has a separate supply of gas from another source, or of electricity or power gas; to have power to refuse supplies to persons in debt for other premises, and also where there are installations of suction-gas plant; to regulate the size and materials of pipes and fittings laid by the consumer on his own premises. They desire the price of gas to be fixed, and provision for different rates according to the puposes for which gas is used; power to produce or buy gas of any description; to form a fund to meet deficiencies and extraordinary claims; and to borrow money.

Rhymney and Aber Valleys Gas and Water Company.—Notice is given by the Rhymney and Aber Valleys Gas and Water Company of a Bill to regulate the supply of both gas and water. The Company desire to have provision made with respect to the supply of gas to persons having a separate supply of gas or electricity, and as to minimum charges and relief from obligation to supply such persons; as to notice to be given by consumers before removing or discontinuing the use of gas; to vary the price charged for gas according to the purpose for which it is supplied; to define their obligations in regard to the supply of gas for purposes other than lighting or domestic use; to enlarge their powers of cutting-off supplies; to enter premises to remove pipes and fittings; to prescribe and enforce specifications for pipes; and make provision as to the placing of meters; and to require the occupier of premises to pay the cost of reconnecting a supply. There are also provisions relating to borrowing powers and other matters.

Rotherham Corporation.—In a General Bill of which notice is given by the Rotherham Corporation, power is to be taken to increase the maximum price for the supply of gas, and to vary the price according to the purpose for which the gas is used.

Spenborough Urban District Council.—A Bill is to be promoted with the object of conferring upon the Spenborough Urban District Council power to acquire the undertakings of the Heckmondwike and Liversedge Gas Company and the Gomersal Gas Company; and to authorize the Council to supply gas within an area comprising the townships of Cleckheaton and Liversedge and the parish of Gomersal and urban district of Spenborough, the township and urban district of Heckmondwike, the parish and urban district of Birkenshaw, and the township and urban district of Hunsworth (except the hamlets of East Bierley and Toftshaw), all in the West Riding of York. They will ask for a calorific value standard and power to charge for thermal units; exemption from the obligation to supply gas when the capacity of the main is insufficient; and expenses of re-connecting the supply after discontinuance to be paid by occupiers. The Bill is also to fix the price of gas, and to provide that the Council may charge different rates in different areas and according to the purposes for which gas is used; to make provision with reference to the purchase by, and sale to, any local authority whose district is beyond the urban district of Spenborough, but wholly or partially within the limits of supply of the Council, of portions of the gas undertaking of the Council within the district of such local authority; to empower the Council to make, produce, or buy, and supply, gas of any description; and to authorize them to borrow money in connection with the purchase scheme.

St. Helens Corporation.—The Corporation of St. Helens desire authority to vary and increase their gas charges; further power with regard to the treatment of residual products, and the purchase, working-up, and sale of products from other gas undertakings; and provision as to the mode of cutting off gas supplies, for charging according to the purposes for which gas is used, and to require the occupiers of premises to bear and pay the expenses of re-connecting premises to the gas-mains of the Corporation after the discontinuance of a supply.

Swansea Gas Company.—Notice is given by the Swansea Gas Light Company of their intention to promote a Bill to substitute thermal units for cubic measurement of the gas supplied; to prescribe standard or basic charges for gas per unit, including differential prices in various parts of the area; to fix standard or basic rates of dividend on existing and new capital; to provide for the application of profits in excess of the basic rates of dividend in the event of a reduction of the selling prices of gas below the basic prices; and to define and provide for the appropriation of the results of good working of the undertaking between the consumers on the one hand and the shareholders and employee co-partners on the other; to confer further capital and borrowing powers on the Company; and to authorize the establishment of a special purposes fund. Another object of the Bill is "to empower the Company to negotiate with any company, body, or person carrying on a gas undertaking, or which may hereafter be established in any district contiguous or near to the Company's limits of supply for the working, purchase, or lease of the undertaking of any such company, body, or person, or the amalgamation thereof with the undertaking of the Company, enter into provisional agreements for any of such purposes, and authorize the Company to subscribe towards the capital of, and to take or hold shares in, or lend money to, any such company, or to guarantee interest or dividends on any of the capital of any such company.

Tendring Hundred Water and Gas.—Alteration and increase are to be sought by the Tendring Hundred Water-Works Company, by means of an Act, of their capital powers, as well as authority to acquire certain land for the purposes of the gas undertaking. They will ask to be empowered to lay a line of pipes from the holder at the works, and passing into, and terminating in, the parish of Kirby-le-Soken, in the rural district of Tendring, by a junction opposite the eastern end of Frinton Railway Station with the existing gas-pipe of the Company; to supply gas upon a thermal basis; and to prescribe a maximum price per unit.

Thames Deep-Water Wharf and Railways.—In a Bill to incorporate a Company for the construction of a wharf, railways, motor road, and other works, the promoters seek authority to prohibit or to regulate or restrict the opening or breaking-up of the intended motor road for the laying of sewers, drains, gas and water mains, electric cables, wires, and apparatus, or for any other purpose; and "to make provision with respect to the discharging of goods and ballast from vessels, the supply of water, gas, and electric light and power for ships' use, and for the general purposes of the undertaking."

Waltham Abbey and Cheshunt Gas Company.—Notice is given by the Waltham Abbey and Cheshunt Gas and Coke Company of a Bill to authorize them to construct new gas-works upon land scheduled, in the urban district of Cheshunt; to raise further capital; to alter the name of the Company; to make and vary profit-sharing schemes for their employees; to provide as to special purposes, reserve, and other funds; and to make further provision with regard to gas supplies and fittings. The Company will also seek authority to apply for powers to supply electricity, and to apply their funds in the exercise of such powers.

Wandsworth, Wimbledon, and Epsom District Gas Company.—Application is intended to be made by the Wandsworth, Wimbledon, and Epsom District Gas Company for leave to introduce a Bill for the transfer to them of the undertaking of the Sutton Gas Company. The Bill will prescribe the consideration (whether in stock or other securities of the Wandsworth Company or in cash, or partly in such stock or securities and partly in cash or otherwise) to be paid by the Wandsworth Company to the Sutton Company, and will make provision as to the carrying-on of the latter Company's undertaking between the date of the passing of the intended Act and the date of transfer of the undertaking. The Wandsworth Company will ask for an extension of their limits of supply by adding thereto the area comprised in the limits of supply of the Sutton Company; for the fixing of standard prices for gas, and an alteration of the method of charge to the thermal unit basis; for the making of provision for the transfer to the Wandsworth Company of all or any of the officers and servants of the Sutton Company, for payment of compensation and gratuities to those removed from office, and for payment of compensation to Directors and Auditors of the Sutton Company for loss of office; for authority to hold and use for the purposes of their business new lands at Epsom which are scheduled; and for additional capital powers. In connection with the financial portion of the Bill, the following clause appears in the notice: "To empower the Wandsworth Company to raise any sum payable under the provisions of the intended Act in cash by selling or issuing to any person willing to subscribe for the same any of their shares, stock, debentures, or debenture stock so created as aforesaid, at such price as the said Company or the Directors thereof may think fit."

Our Three-Thousandth Issue.—"A.Inst.C.E." writes: "I should like to congratulate you on your 3000th issue. I have read with pleasure your excellent paper for 66 years, and for the past 42 years have been a subscriber." This letter was prompted by a paragraph that appeared on p. 381 of our issue for Nov. 17. We thank our old subscriber for his congratulations.

Lighting of Dublin.—Full gas and electric lighting has now been resumed in the Dublin Metropolitan area, under the direction of the Lord Mayor (Mr. L. O'Neill), following the tragic events of Sunday week. The danger to life and property was at once apparent; and the Lord Mayor thought it better to depart from the regulation as to darkness during curfew hours laid down by the Council, and to rely on that body to support his emergency action. In the suburban parts especially the renewed gas lighting has been warmly approved.

Douglas (Lanarkshire) Gas-Works.—An offer was submitted to the Lanarkshire District Committee by the Douglas Gas Light Company to dispose of their gas-works as a going concern. The Clerk stated that this matter had been before the District Committee a year ago; and it was then decided to allow it to drop, in view of the fact that there was no application from the ratepayers. The Clerk stated that it would be a serious matter if Douglas were left without a service of gas. It might be their duty to see that the works were continued, or it even might be better to start new works. On a division, it was resolved by a majority that no action be taken meantime.

MISCELLANEOUS NEWS.

THE GAS INDUSTRY AND RAILWAY RATES.

A National Gas Council Witness.

On Thursday last, the Railway Rates Advisory Committee heard further evidence—Mr. Gore Browne, K.C., presiding. Part of the sitting was occupied in hearing what Mr. S. S. Ogilvie had to advance on behalf of the National Gas Council.

Witness, replying to Mr. Jaques Abady, who appeared for the Council, said that that body represented about 94 p.ct. of the total make of gas in the United Kingdom, and embraced both companies and municipal authorities. The question of railway transport was of vital importance to the industry—seeing that practically every undertaking was situated upon a railway, and also that the industry was the second largest consumer of coal in the United Kingdom. Owing to the use of gas for industrial power purposes, it was essential that coal, coke, and patent fuel should be placed in a class by themselves at the lowest rates; otherwise a large number of important industries, in addition to the gas industry, would be prejudiced materially.

With regard to private sidings, the gas industry supported the view held by the Federation of British Industries, that a strict definition should be given of the term "conveyance rate," in order to make quite clear what services were covered by this rate—and such rate in the case of "through" traffic should be calculated on a "continuous mileage" for the whole journey. In addition to the charges for conveyance, only those services which were actually performed at a private siding should be paid for. At the same time, it was contended that no increased charge for conveyance should be made in respect of coal, coke, and patent fuel. It was suggested that the charges for such services should always be settled by an independent and impartial tribunal.

The question of "dangerous goods" was not specifically dealt with in evidence, as the gas industry adopted the evidence of Mr. Lukes, the Chairman of the Traffic Committee of the Association of British Chemical Manufacturers. The two most important propositions on this point are that in future the railway companies should not have unfettered discretion to say what goods were dangerous and what goods were not; also that when it had been decided what goods were dangerous, they should not have the sole power of fixing the rates for such goods. It was also suggested that in future the "impartial tribunal" should decide both these questions.

The gas industry also opposed any further concessions to the railway companies with regard to "short hauls," and suggested that the present scale should remain in force.

Finally, the gas industry asked: (1) For fairer treatment with regard to the demurrage charged against gas undertakings by railway companies; and (2) that they should have the same powers and facilities of recovering demurrage from the railway companies as the railway companies had from them.

Detailed instances and examples relating to the above points were given on behalf of many gas undertakings, including the Birmingham and Coventry Gas Departments, the Edinburgh, Macclesfield, Oldham, Ossett, and Spenborough Corporations, and the Bournemouth, Bridlington, Eastbourne, Felixstowe, Gloucester, Hartlepool, Highbridge, Newmarket, Reading, Ryde, Stirling, Stretford, and Weston-super-Mare Gas Companies.

GAS REGULATION ACT APPLICATIONS.

The following further notices appear in the "London Gazette" of applications by gas undertakings to the Board of Trade under section 1 of the Gas Regulation Act for Orders providing for—(*a*) The repeal of any enactments or other provisions requiring the undertakers to supply gas of any particular illuminating [or calorific] value, and the substitution therefor of power to charge for thermal units supplied in the form of gas; and (*b*) the modification of the statutory or other provisions affecting the charges which may be made by the undertakers by substituting for the maximum [or standard] price per 1000 c.ft. now authorized, with an addition to meet increases in the costs and charges of, and incidental to, the production and supply of gas by the undertakers since June 30, 1914, a maximum [or standard] price per therm (100,000 B.Th.U.).

A copy of the applications made to the Board of Trade, and of all the documents submitted therewith, may be inspected, free of charge, at the gas offices concerned.

Any local authority or person desiring to make representations with regard to the application may do so by letter addressed to the Assistant Secretary, "Power, Transport, and Economic Department," Board of Trade, Great George Street, S.W., and posted not later than the date specified in the notice.

Burnham Gas Company, Ltd.

The maximum price now authorized in respect of the supply of gas by the undertakers is 4s. 9d. per 1000 c.ft.; and the price which they ask the Board of Trade to substitute for this is 1s. 8½d. per therm.

Earby and Thornton Gas and Lighting Company, Ltd.

The standard price now authorized in respect of the supply of gas by the undertakers is 4s. per 1000 c.ft.; and the price which they have asked the Board of Trade to substitute for this is 1s. 6d. per therm.

Gorleston and Southtown Gas Company.

The maximum price now authorized in respect of the supply of gas by the undertakers is 4s. 9d. per 1000 c.ft.; and the price which they have asked the Board of Trade to substitute is 1s. 11d. per therm.

Ilford Gas Company.

The standard price now authorized in respect of the supply of gas by the undertakers is 4s. 6d. per 1000 c.ft.; and the price which they ask the Board of Trade to substitute for this is 1s. 8d. per therm.

Ipswich Gas Light Company.

The standard price now authorized in respect of the supply of gas by the undertakers is 3s. 9d. per 1000 c.ft.; and the price which they have asked the Board of Trade to substitute is 1s. 4d. per therm.

Rugby Gas Company.

The standard prices now authorized in respect of the supply of gas by the undertakers is 3s. 8d. per 1000 c.ft. in the parish of Rugby (the inner area), and 4s. 8d. per 1000 c.ft. in any other part of their district (the outer area); and the prices which they have asked the Board of Trade to substitute for these are 1s. 5·8d. per therm in the parish of Rugby, and 1s. 8·2d. in any other part of their district.

Wolverhampton Gas Company.

The standard price now authorized in respect of the supply of gas by the undertakers is 2s. 9d. per 1000 c.ft.; and the price which they have asked the Board of Trade to substitute for this is 1s. 4d. per therm.

COATBRIDGE GAS COMPANY AND THE REGULATION ACT.

Opposition by the Town Council.

A Special Meeting of the Coatbridge Town Council was convened to consider a recommendation by the Fire and Lighting Committee with regard to an application being made by the Coatbridge Gas Company to the Board of Trade for new powers in connection with the supply and price of gas.

The minute of the Committee was to the effect that they had considered the notice of application by the Company for an Order under section 1 of the Gas Regulation Act, providing for power to charge for gas by the therm, and to substitute the price of 14d. per therm for the present authorized standard price of 2s. 6d. per 1000 c.ft. The Committee learned that the Convention of Royal Burghs had so far taken no action in the matter; but the Agent (Mr. Officer) explained that, according to his information, such applications were being generally made by private companies in Scotland. In his view, no expense would fall upon individual consumers, as the Act provided that the Order shall contain provision requiring the undertakers, at their own expense, to make any alterations necessary to consumers' appliances. Mr. Thomson (the Burgh Analyst) informed the Committee that a price of 14d. per therm would be equivalent to a price of 5s. 3d. per 1000 c.ft., and that a price of 6·66d. per therm would be equivalent to the present standard price of 2s. 6d. per 1000 c.ft. After discussion, the Committee unanimously resolved to recommend that the Town Clerk should lodge objection with the Board of Trade against the proposal to charge a price of 14d. per therm, and to represent that the price of 6·66d. per therm should be substituted therefor; and also against any modification being made in the provisions contained in the Company's Act, whereby the rate of dividend payable by the Company is dependent on the price of gas supplied.

Treasurer SMITH pointed out that what the Council had to see to was that the Company did not, by the change in the rate, charge the consumer more than the present rate.

Mr. HUGH MARTIN said the Company were paying dividends on the basis of 2s. 10d. per 1000 c.ft., which was the present price of gas.

Provost LAVELLE said in that case the Company's dividends would be affected to the extent of £1.

The TREASURER moved that the Council should adopt the Committee's recommendation, and oppose the Company's being allowed to increase the rate.

Mr. AGNEW seconded. He thought the Committee should be instructed to offer the utmost possible resistance to this Provincial Order and claim of the Company. He suggested that they might get into touch with other local authorities similarly situated, with a view to taking joint action. Assuming that their price of gas was 1s. 6d. in 1914, he pointed out that the Company had had the natural increase that came in respect of the war; and that the charge to the community was now 2s. 10d. The serious matter here was that the Company now wanted to establish a new standard, abolishing the 2s. 6d. standard, and possibly also, the sliding-scale as to dividends. But even if the sliding-scale was safeguarded, it would not come into operation until they had reached the new standard of 5s. 3d. This meant that at the present price of 2s. 10d., there would have to be an additional increase of 2s. 5d. before the sliding-scale principle came into operation. He considered it was not fair or reasonable that they should have such a big margin as this before any decrease took place in their dividends. The Council should oppose this increased standard on behalf of the community.

The Committee's recommendation was unanimously adopted, and they were empowered to take steps to oppose the application.

ASSOCIATION OF STATUTORY INSPECTORS OF GAS-METERS.

Executive Council Meet in Manchester.

The Executive Council of the Association of Statutory Inspectors of Gas-Meters, with representatives from the members' respective authorities administering the Acts which govern the use of measures dealing with the sales of gas, were received at the Manchester Gas-Meter Testing Station by the Chairman (Mr. H. N. Barrow, J.P.) and members of the Justices Committee. The object of the meeting was to

inspect Manchester's methods for the testing of gas-meters, and to discuss the draft regulations of the Board of Trade recently issued for the better regulation of meter testing.

The Chief Inspector (Mr. S. Dyson) explained how they proposed to deal with the new test for internal and external soundness of meters. It was afterwards agreed that Manchester's system of using air compressed by a combined electric motor and fan was capable of giving the desired pressures. Mr. Dyson also pointed out how they would increase the indicating capacity of their pressure gauges by increasing the size of the wheel.

The visitors were entertained to lunch in the Town Hall by the Lord Mayor (Alderman Kay), who said he was much interested in the work of the Association, although he was more concerned with the selling of gas. He welcomed them in the name of Manchester, and hoped their visit would prove profitable.

At the subsequent meeting in the Justices Board Room, Mr. Barrow (who is a Vice-President of the Association) paid tribute to the value of the services rendered by their President (Mr. J. Ollis) to the Association and the community at large. Mr. Ollis was the Chief Officer of the Control Department of the London County Council, and had many offices under his control where meters were tested. He had successfully presided over and directed the affairs of the Joint Conferences in London, and he introduced the deputation with its agreed memorandum to the Board of Trade, with the result that they had before them—the draft regulations recently issued by the Board of Trade, which embodied very largely the suggestions put forward. Their thanks were due to Mr. Ollis.

Mr. Ollis, who was accorded a hearty reception, said that he felt he had really done very little; but he had profited by what he had heard of different points of view. The questions raised had been thoroughly discussed from many points of view in order to arrive at agreement. Therefore, he advised the working of the regulations for a period before pushing forward any desired alteration or amendment of them. In the meantime, he would suggest that inspectors might advantageously send in to their Secretary any suggestions they may desire to be considered, with a view to agreement among themselves. This should help the matter a great deal. He called upon the Chairman of the Executive Council (Mr. C. Hume) to answer any question on which any member might desire information.

Mr. Hume took the regulations clause by clause, and many explanations were called for and answered, although not quite to the satisfaction of everyone. All agreed, however, that the explanations had helped them to realize the importance of the President's counsel.

Mr. Ollis, in returning thanks, said there was one matter he thought they should have in mind, and that was where the regulations laid down the use of a stamp of uniform design. He felt that ordinary persons could not know by the stamp issued by the Board of Trade where a meter had been stamped—whether in London or in Manchester. He could not help thinking that the old practice of affixing the local stamp in addition was an advantage.

PRESENTATION TO MR. W. H. SHERBURN, OF WARRINGTON.

An interesting event took place the other evening at the works of the Richmond Gas-Stove Company, where the members of the staff foregathered to make a presentation to Mr. W. H. Sherburn, of Stockton Heath, who has retired from business after long active association with the Company. The chair was occupied by Mr. J. W. Slack, supported by Mr. Arthur Slack (Secretary) and the various departmental managers. After light refreshments, Mr. Caldwell read apologies for absence from Mr. H. M. Thornton, J.P., and members of the staff in various parts of the country who were unable to attend; and subsequently Mr. J. W. Slack, on behalf of the Directors and staff, presented a massive chiming timepiece, together with a silver cigarette case, to Mr. Sherburn, and a gold wristlet watch to Mrs. Sherburn, as marks of esteem—all the presents being suitably inscribed.

In making the presentation, Mr. Slack referred to the long and faithful service which had been rendered to the Company by their guest. He indicated the remarkable progress of the Company, and outlined the rapid advances that had been made in the design and production of gas apparatus, particularly during the twenty years that Mr. Sherburn had been associated with the Company. Mr. Slack particularly referred to the progress made during this period in gas-fire construction. In point of design, scientific construction, finish, and mass production, the gas-fire had experienced a wonderful evolution during the past few years. In the development of gas apparatus, Mr. Sherburn had wielded considerable influence; and the products of the Richmond Company bore many evidences of his personality. It would be interesting to know that, while Mr. Sherburn was going into well-earned retirement, arrangements had been made whereby he would still retain an interest in the further efforts of the Company.

Mr. Sherburn, who was enthusiastically received, expressed his thanks for the gifts and the spirit of goodwill which they indicated. On such occasions as these, he said, one was tempted to become reminiscent. For over forty years he had been engaged in evolving gas apparatus of many types; and the developments during that period had been remarkable. It was a great delight to recall his association with the Directors of the Company, his colleagues, and the employees; while to the boys, on the threshold of their industrial career, his feelings had always been happy and cordial. He had always taken a deep interest in his work, and was quite satisfied that if personal interest was shown by everyone (no matter the position occupied), and the cordial relations which had existed in the past were maintained and stimulated, the Company's achievements, great as they had been, would be excelled in future.

Mrs. Sherburn was called upon, and she also expressed her thanks for the beautiful tokens she and her husband had received, and for the many kind words which had been uttered.

The proceedings closed with musical honours to the guests.

A TRIUMPH FOR BRITISH ENTERPRISE.

THESE UNIQUE PRODUCTS

Synchronise the requirements of the concrete age and will revolutionise building construction.

NOVOID
THE CONCRETE PROOFER
REGISTERED TRADE MARK

A powder which chemically acts upon Portland cement, and renders concrete weather, water, and oil proof by filling the voids with insoluble silicates.

"Novoided Concrete is Bone Dry under Pressure."

RENCRETE
REGISTERED TRADE MARK
The Weatherproofer

A solution similar to Everok, in a variety of practical shades, for proofing brick, plaster, stucco, etc., and rendering concrete decorative as well as weatherproof.

"The First Successful Effort in Cement Stains."

EVEROK
THE WATERPROOFER
REGISTERED TRADE MARK

A colourless solution on the Novoid principle for proofing and hardening existing cement, concrete, brick, etc. Eminently suitable for concrete floors, to prevent "dusting up," as it

"Sets Like a Rock."

QUELLE
REGISTERED TRADE MARK
THE FLAMEPROOFER

A preservative stain made in colours, to represent pitch pine, oak, walnut, etc., which renders woodwork fire, moisture, and rot-resisting, and prevents even green timber from shrinking or swelling.

"A Perfect Primer for Enamel."

BOOKLET POST FREE BY STATING THIS PAPER.

AURORA
REGISTERED TRADE MARK
DISTEMPER

WRITE FOR TINT CARD AND PRICE LIST POST FREE.

The latest and most economical water paint. Supplied ready for the brush. Surfaces 640 yds. per cwt. on "Sirapite." Being "colloidal" in action, it becomes an integral part of the plaster itself.

"A Really Washable Distemper."

"THE KEENEST CRITICS HAVE BEEN CONVINCED THAT WHAT IS NOW PUT BEFORE THEM IS THE TRUTH."

THE TORBAY & DART PAINT COMPANY, Ltd., 26-28, Billiter St., LONDON, E.C.3

TORONTO CONSUMERS' GAS COMPANY.

The seventy-second annual report and accounts (for the year ended Sept. 30) were submitted and adopted at the meeting of the Consumers' Gas Company of Toronto, on Monday, Oct. 25.

The report recorded a substantial increase of 10·28 p.ct. in the quantity of gas sold, and of 5760 in the total number of consumers supplied. Notwithstanding strong electrical competition encountered during the past ten years, the output of gas in this period has nearly doubled. The number of consumers has also increased about 90 p.ct. in the same time, though the population served by the Company has grown only 44 p.ct. The profit and loss account, after payment of the usual dividend, showed a surplus of $129,708·93, which amount has been placed to the credit of the reserve fund. The year's operations were affected by marked increases in the prices of all commodities necessary for the manufacture and distribution of gas. During the past three months, prices advanced at a greater rate than in any similar period in the Company's history. Both coal and gas oil have advanced to prices undreamed of in the past; and the Company are paying for these materials at the present time from two to three-and-a-half times the prices paid in 1915. There is no indication of any immediate reduction of costs. The Company will therefore have to meet a greater burden during the coming year. This fact has made it necessary for the Directors to raise the price of gas to the consumers by 15 c. per 1000 c.ft., making the net charge $1.25 per 1000 c.ft. Though the high rates paid for labour have added largely to the Company's operating expenses, this item would have been much more serious had it not been for the wise policy of having in the past provided an effective system of practical labour-saving equipment. To meet the increasing demand for gas, it has become necessary to make additions to the manufacturing plant. The new equipment, which is now under construction, consists of two oil-gas sets, having a capacity of 4,000,000 c.ft. of gas per day.

The President (Mr. A. W. Austin), foreshadowing a further capital issue, said the unissued shares of the present authorized capital stock of the Company amount to $639,000 par value. "During the year," he went on, "Mr. W. H. Pearson, our former General Manager, passed to his reward. He was with the Company for 55 years, retiring some years ago. Mr. Pearson worked and lived to see the Company the largest gas company in Canada. He performed his duties honestly, faithfully, and intelligently, with unusual devotion to the welfare of this institution and the community at large. I am glad we were able to obtain the portrait of him which now graces a wall of this room. It will always remind us of his clean, untarnished record, and honourable, useful life."

The General Manager (Mr. Arthur Hewitt) demonstrated the development of the Company during the war period and since, by means of a chart, which indicated a slight decrease in the output of gas in 1915, due to the fact that there were approximately 7500 vacant premises in Toronto in that year. There was a slight recovery in 1916; and during 1917 and 1918 substantial increases were shown, owing principally to the large quantities of gas used in munition plants. During the past year there had been a very substantial increase in gas sales, due to the more general use of gas in the industries, and to the growth of the city. When gas formerly was $1.25 per 1000 c.ft., the dividend charge was equal to 40 c. per 1000 c.ft. of gas sold; while at the present time, dividend and interest charges amount to less than 12½ c. He also brought to the attention of the shareholders the point that the dividend and interest requirements amounted to a charge of only 5·15 p.ct. upon the amount invested in the Company. As 10 p.ct. is the rate of the dividend, this gives an impression that the Company are actually paying 10 p.ct. on the amount invested by shareholders; whereas the fact is that, inasmuch as a large portion of the stock has been purchased at a high premium, the actual return to the shareholders is less than 6 p.ct. per annum.

TRADE NOTES.

[For "Journal" Advertisers.]

Welsbach Gas-Fittings List.

The Welsbach Light Company, Ltd., of Welsbach House, King's Cross, W.C., forward a copy of their list of gas-fittings and accessories for the season 1920-21. It illustrates brackets and pendants for all kinds of incandescent lighting requirements, with a selection of silk shades, boiling-rings, grillers, &c.

Richmond Apparatus at the Advertising Exhibition.

At the International Advertising Exhibition which is being held at the White City this week, a very interesting "Advertisers' House" is to be seen, in which every article employed in construction and equipment has been made familiar to the public by advertising. The Richmond Gas Stove and Meter Company, Ltd., have three pieces of apparatus—viz., their "Bungalow" gas-cooker, "Tay" gas-geyser, and "Period" gas-fire. A well-known firm of London printers are also showing a Richmond "Period" gas-fire on their stand, together with a display of "Period" brochures for the printing of which they were responsible. The compliment thus paid to "Richmond" advertising serves the double purpose of promoting good printing and emphasizing the advantages of a modern high-class gas-fire.

Consequent upon the successful installation of "A. & M." patent pressure-wave automatic controllers at Ardrossan, the Town Council have now decided to have the whole town completed, necessitating the fitting-up of a further 52 lamps.

AUTOMATIC GAS CONTROL.

Of the many factors in the remarkable measure of success attained by our "St. Magnus" Gas Heated Steam Radiators, not the least is the

Main Patent Automatic Double Injector Valve.

It ensures the maintenance of an even heat with the absolute minimum gas consumption. Is equipped with a ready means of securing a perfect Bunsen flame, whatever the quality of gas.

It retains its positive action under actual working conditions and is not liable to become inoperative or uncertain.

R. & A. MAIN, LTD.,

WORKS: Gothic Works, EDMONTON, N.18; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.
SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W. 1; 82, Gordon Street, GLASGOW; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 6, Narrow Wine Street, BRISTOL; 333, Queen Street, MELBOURNE.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Nov.* 29.

The market for tar products is quiet; but prices remain steady. Pitch is quoted at not below 225s. per ton f.o.b. makers' works. There is a considerable amount of inquiry for tar for road work for next season's delivery. Creosote is about 1s. 4d. per gallon net in bulk. There is no demand for pyridine, the price being called 18s. per gallon nominal. Pure benzole and pure toluol are steady at from 4s. 3d. to 4s. 6d. per gallon. Solvent naphtha, 95-160, is about 3s. 7½d. to 3s. 9d. per gallon.

The price ruling for sulphate of ammonia for December for the home market is £26 per ton to farmers, with a discount of 10s. per ton to dealers, basis 24½ p.ct.

Tar Products in the Provinces.

Nov. 29.

The average values for gas-works' products during the week were: Gas-works coal tar, 120s. to 125s. Pitch, East Coast, 180s. to 190s. per ton f.a.s.; West Coast—Manchester, 180s. to 185s.; Liverpool, 180s. to 185s.; Clyde, 185s. to 190s. nominal. Benzole 90 p.ct. North, 3s. 1d. to 3s. 2d.; crude 65 p.ct. at 120° C., 2s. 3d. to 2s. 5d. naked at makers' works; 50-90 p.ct. naked, North, 3s. 2d. to 3s. 3d. Toluol, naked, North, 3s. 1½d. to 3s. 2½d. nominal. Coal tar crude naphtha in bulk, North, 1s. 2d. to 1s. 3d. Solvent naphtha, naked, North, 3s. to 3s. 2d. Heavy naphtha, North, 3s. 1d. to 3s. 3d. Creosote, in bulk, North, liquid, 1s. 0¾d. to 1s. 1¾d.; salty, 1s. to 1s. 1d. Heavy oils, in bulk, North, 1s. 1d. to 1s. 2d. Carbolic acid, 60 p.ct., 2s. 7½d. to 2s. 9d. Naphthalene, £37 10s. to £40; salts, £10 to £10 10s., bags included. Anthracene, "A" quality, 1s. per minimum 40 p.ct.; "B" quality, nominal.

FROM A MARKET CORRESPONDENT.

Tar Products.

Business is quiet, and not much trade is passing. Values are fairly well maintained; but there is a distinct tendency towards a lower level. With this idea in mind, consumers are holding off the market. This is particularly the case in pitch, which is being bought only to cover immediate needs. In some quarters prices are fully £1 per ton lower than a week ago. It is possible, of course, that some consumers still have supplies which the coal strike prevented being used-up; but the fact remains that orders are scarce—buyers apparently waiting to see what may happen before coming into the market again. The strongest section of the market is creosote, which is slightly dearer. At the other end is carbolic acid. This market is dull and on the weak side, on reports that large quantities of crystals are coming back from France and Japan. There are very few inquiries for, and practically no business in, naphthas; but naphthalenes are possibly rather lower, while the Government are allowing small exports under licence. Refined is lower; but crudes are still dear.

Latest values are as follows:

Benzole: 90% London 4s. 1d., North 3s. 10d. to 3s. 11d.; 50-90% 3s. 6d. London, 3s. 3d. to 3s. 4d. North; crude 60-65%, 2s. 5d. to 2s. 7d.; pure, 4s. 3d. per gallon naked.

Crude Tar: London, 105s. to 115s.; Midlands, 107s. 6d. to 117s. 6d.; North, 105s. to 115s. per ton *ex* works. Refined tar, 95s. per barrel (free) on rail.

Pitch: London, 210s. to 220s. per ton f.o.b.; East Coast, 205s. to 212s. 6d. per ton f.o.b.; West Coast, 202s. 6d. to 207s. 6d. f.a.s., with Manchester 220s. per ton, and Glasgow 215s. per ton; South Wales, 220s. per ton.

Solvent Naphtha: London, 3s. 2d.; Provinces average 3s. 1d. per gallon.

Crude Naphtha: Naked, 1s. 1d. to 1s. 2d.; North, 1s. per gallon.

Heavy Naphtha: 3s. 4d. per gallon.

Naphthalene: Refined flake, £45 per ton nominal; inferior, £35; crude, £16 to £25 per ton, according to quality.

Toluol: Naked, 3s. 4d. per gallon nominal; North, 3s. 2d.; pure, 4s.

Creosote: London, 1s. 3d. to 1s. 4½d.; North, 1s. 3½d.; heavy oil, 11½d. per gallon in bulk.

Anthracene: 40-45%, 1s. 4d. to 1s. 6d. per unit per cwt.

Grease Oils: 18° Tw. (naked), £6 10s. per ton f.o.r. makers' works.

Pyridine: 20s. to 25s. per gallon.

Aniline Oil: 1s. 8d. per lb., drums extra.

Aniline Salts: 1s. 10d. per lb.

Cresylic Acid: Crude, 3s. 9d.; 95%, 4s. 3d. to 4s. 9d.; 97-99% 4s. 9d. to 5s. 3d.; pure 6s. per gallon *ex* works London, f.o.b. other ports.

Carbolic Acid: Crude 60%, 3s. 9d. per gallon; crystals 40%, 8d. per lb. nominal.

Salicylic Acid: Technical, 2s. 4d.; B.P., 3s. per lb.

Xylol: Pure, 5s. 6d.; commercial, 4s. 9d. per gallon.

Resorcin: 12s. to 13s. per lb.

Alizarine 20%: 2s. per lb.

B. Naphthol: 3s. per lb.

Sulphate of Ammonia.

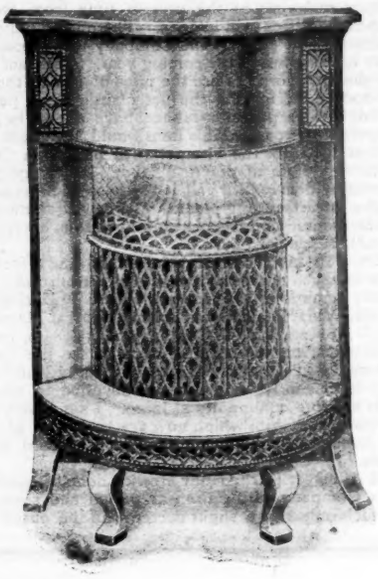
The recent coal strike, it appears, had a small effect upon the output of sulphate, but not sufficient to necessitate any advance in prices. Except that deliveries are temporarily in arrears, there is but little change in conditions. The demand is at present quiet, which gives makers an opportunity to clear off outstanding orders and make some preparations for the business which comes along regularly with the turn of the year. Synthetic nitrogen is receiving the attention it demands; and the possibilities of German competition in this direction are not being overlooked. In America, prices are low; but there is no pressure to sell.

RICHMOND'S

"WESTMINSTER"

GASFIRE.

"R.H.D." (Radiant Heat Distributor) Series.



This new design is a development of Richmond's original "R.H.D." (Radiant Heat Distributor) Gasfire, which marked an epoch in gasfire construction when first introduced in 1915.

The semi-circular fire-front ensures a perfect distribution of radiant heat to every corner of the room—no part escapes its hygienic warming influence.

Numerous air ports provide for ample ventilation, maintaining a warm and hygienic atmosphere.

Richmond's "St. James" and "Westminster" are the first and only Gasfires on the market that distribute radiant heat to the whole of the family circle.

THE RICHMOND

GAS STOVE & METER CO., Ltd.

WARRINGTON —— and —— LONDON

John Thompson (Gas Developments), Ltd., has been registered, with a capital of £175,000, in £1 shares. The offices are at Ettingshall, Staffs.

Difficulties at Batley.—Batley is suffering from a serious deficiency in its gas supply; and the Manager (Mr. R. H. Duxbury) and his staff are having a difficult time in the effort to cope with the demand. The plant is admittedly inadequate; and it was hoped to have fixed and working in September last a carburetted hydrogen apparatus, as a temporary means of increasing the output. Unfortunately, owing to shortage of material and skilled labour, the installation is not yet completed; but one generator is at work, and has done much to ameliorate the situation, and has prevented the position from becoming critical. It is announced that the existing retorts have become very much the worse for wear under the heavy strain of the past twelve months, and that there is little prospect of any material improvement in supply before the new year. Under an agreement of last year, the Birstall District Council are providing Batley with an auxiliary supply.

Lighting of Queenstown.—At a meeting of Queenstown Urban Council, the Clerk said he had received a number of resolutions protesting against the action of the Gas Company in seeking to increase the price of gas from 7s. to 8s. 1d. per 1000 c.ft. The Council had already reduced the Company's account for the half year by £55 in respect of lamps that were not lighted. Action on the question of the increase was deferred.

Gas on a Lambeth Housing Estate.—The Lambeth Borough Council have been informed by H.M. Office of Works that, in regard to the lighting and heating of the new dwellings which they are erecting for the Council on the St. Louis Road Site, it is proposed to adopt the following arrangements: The whole of the lighting throughout to be by gas; and each house to have a gas-cooker, a gas-copper, a gas-circulator, and an inter-oven in the living-room. The Council have informed the Office of Works that, subject to the substitution of ordinary fire-coppers for the suggested gas-coppers, they are prepared to approve of these arrangements.

STOCK MARKET REPORT.

THE Stock Exchange has had another disagreeable week—even worse than the last, and that is saying a good deal. The motive power was the same, but increased, and increasing, in degree—viz., the pressure to realize, both at home and abroad, which caused very heavy shrinkage of prices. The best that can be said is that Friday brought one cheering ray—the pressure relaxed somewhat, and in a few lines there was a slight rally.

Another good point is that Home Government issues bore up remarkably well; Friday's closing prices of the big four being not very far from the opening figures on Monday—viz., Consols 44¼-44⅝, War Loan 82⅜-83¼, Funding 66⅜-67⅛, Victory 73-73¼. Bonds were weaker, and Corporation issues gave way. Home Rails ordinaries weakened, but closed steady, and prior charges hardly suffered. Canadians were not much hurt, but Argentines had a decided fall.

The Foreign Market was flat nearly all round, only one or two special lines escaping a drop in quotation.

The Miscellaneous Market was a considerable sufferer; undertakings of multifarious descriptions being freely put down. Oils were conspicuous in this respect; but they began to rally before the close.

Business in the Gas Market showed a falling-off in activity, and few of the minor undertakings were dealt in at all, and then only in single bargains. Firmness was not to be expected in such a time of widespread weakness; but here and there a gain was scored. In the London Companies, Gas Light ordinary fell 2, South Metropolitan 4. In Suburban and Provincial, Alliance and Dublin rose 2, Croydon "B" and "C" 5, and South Suburban 1. Brighton and Hove had a rather curious experience. On Tuesday, the original stock was sold at 99⅜ and the ordinary at 69⅜; on Friday, the former was done at 115 and the latter at 80! The true inwardness of this is not apparent. In Continentals, Imperial was weaker, and lowered 5. Primitiva made no sign.

Bargains done for cash during the week were as follows: On Monday, British 21, European 6⅛, Gas Light ordinary 53½, 53¾, 54, 54¼, 54½, ditto maximum 37, Ilford "A" and "C" 80, ditto "B" 58, Imperial Continental 138, 138½, 138⅛, 139, 140, ditto debenture 92, 92½, 93, 94⅛, Primitiva preference 20s. 6d., 21s., Sheffield "C" 59⅛, South Metropolitan 59, 60, South Suburban 59, Tottenham "B" 51. On Tuesday, Alliance and Dublin 39½, Brighton and Hove original 99¾, 100, ditto "A" ordinary 69⅜, 70, European 6 1/16, Gas Light ordinary 53, 53⅛, 53⅜, 53¾, ditto preference 57, ditto debenture 46½, Imperial Continental 137⅛, 138, 138⅛, 139½, ditto debenture 93¾, Oriental 98, Primitiva preference 20s., South Metropolitan 60, 61, Tottenham "B" 52, 52½, Richmond 5 p.ct. ordinary 47. On Wednesday, Commercial 4 p.ct. 55, Gas Light ordinary 52⅛, 52⅝, 52⅞, 53, ditto debenture 46½, Imperial Continental 137, 137⅛, 138, 138⅛, South Metropolitan 59. On Thursday, Bournemouth "B" 8⅞, 8 1/16, Gas Light maximum 38, 38⅛, ditto preference 57⅛, Imperial Continental 135, 136, 137½, South Metropolitan 58, 58⅛, 58⅜, 59. On Friday, Alliance and Dublin 41, Bombay 4⅛, Brighton and Hove original 115, ditto "A" ordinary 80, European 6, Gas Light ordinary 52, 52⅛, 52⅜, 53, 53¼, ditto preference 56, Imperial Continental 134½, 135, Primitiva preference 21s., South Metropolitan 57⅞, 58.

In the Money Market, rates opened steady at about the previous week's closing figures; but they soon hardened materially in face of the strong demand which sprang up. Discount was firm. The Bank rate is 7 p.ct., fixed on April 17 last.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Ante-War Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices, July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
£			p.c.					
182,049	Stk.	Aug. 27	4	4%	Aldershot 4 p.c. Pref. .	...	56—61	...
1,551,868	,,	Oct. 14	2½	3 1/18%	Alliance & Dublin Ord.	59—64	38—43	39½—41
374,000	,,	July 14	4	4%	Do. 4 p.c. Deb.	76—79	47—52	...
280,000	5	Oct. 28	7½	8%	Bombay, Ltd. . . .	5¼—6¼	4¼—4⅝	4⅛
100,000	5	Aug. 12	16	5%			8—9	...
383,110	10	,,	7	7%	Bournemouth Gas and Water { 5 p.c. . . / B 7 p.c. . / Pref. 6 p.c. / 4 p.c. Deb.	15—15½	8½—9⅛	8⅞—8 1/16
115,000	10	,,	6	6/-		13¼—14	7⅛—8⅛	...
162,065	—	June 25	—	4%		...	62—64	...
992,045	Stk.	July 14	14	30/-	Brentford A Consolid. .	261—266	50—55	...
734,920	,,	,,	11	26/3	Do. B New . .	204—209	47—52	...
55,000	,,	,,	5	5%	Do. 5 p.c. Pref. .	109—111	68—73	...
221,400	,,	June 10	4	4%	Do. 4 p.c. Deb. .	91—93	60—63	...
214,775	,,	Aug. 27	11	7½%	Brighton & Hove Orig. .	208—213	110—120	99½—115
244,200	,,	,,	8	5⅛%	Do. A Ord. Stk.	154—159	75—83	69½—80
1,287,500	Stk.	July 29	5	5%	Bristol 5 p.c. max. . .	...	...	...
530,000	20	Sept. 15	12½	10%	British	44—45	20—22	21
120,000	Stk.	June 25	4	4%	Do. 4 p.c. Deb. Stk.	88—90	57—59	...
245,771	,,	,,	4	4%	Buenos Aires 4 p.c. Deb.	85—87	39—42	...
100,000	10	May 27	—	—	Cape Town & Dis., Ltd.	1¼—2¼	7—7½	...
100,000	10	,,	—	4½%	Do. 4½ p.c. Pref. .	4—6	5¼—6½	...
100,000	Stk.	June 25	4½	4½%	Do. 4½ pc. Deb. Stk.	70—75	56—61	...
157,150	,,	Feb. 26	5	5%	Chester 5 p.c. Ord. . .	108—110	...	...
1,513,280	,,	Aug. 12	5/9/4	30/-	Commercial 4 p.c. Stk.	106—108	54—59	55
560,000	,,	,,	5½	26/3	Do. 3½ p.c. do.	103—105	47—52	...
475,000	,,	June 10	3	3%	Do. 3 p.c. Deb. Stk.	69¼—71¼	45—47	...
800,000	,,	Dec. 11	4	—	Continental Union Ltd.	76—79	25—30	...
200,000	,,	,,	7	—	Do. 7 p.c. Pref.	115—118	40—50	...
51,600	,,	Aug. 27	14½	10½%	Croydon A 10 p.c. . .	...	125—135	...
278,400	,,	,,	11½	7½%	Croydon B and C 7 p.c.	..	90—100	...
492,270	Stk.	—	6	5%	Derby Con. Stk. . .	123—125	...	...
55,000	,,	—	4	4%	Do. Deb. Stk. .	102—104	...	...
1,002,180	10	Jan. 29	10	5/0	European, Ltd. . . .	17½—18	6—7	6—6½
16,298,975	Stk.	July 29	4/17/4	30/-	Gas Light and Coke { 4 p.c. Ord. . . / 3½ p.c. max. / 4 p.c. Con. Pref. / 3 p.c. Con. Deb.	98—102	51—54	52—54½
2,600,000	,,	,,	3½	26/3		76—79	36—39	37—38½
4,062,235	,,	,,	4	4%		96—99	55—58	56—57½
4,674,850	,,	June 25	3	3%		72½—74½	45—48	46—46½
130,000	,,	Dec. 11	10	10%	10 p.c. Bonds. .	...	...	...
82,500	,,	Sept. 15	5	3⅛%	Hastings & St. L. 5 p.c.	...	53—58	...
258,740	,,	,,	3½	2⅛%	Do. 3½ p.c.	87—89	37—39	...
70,000	10	May 13	11	8%	Hongkong & China, Ltd.	16½—16¾	8½—9½	...
86,600	Stk.	Sept. 15	9	5⅝%	Hornsey 7 p.c. . . .	...	87—89	...
131,000	,,	Aug. 12	7½	4½%	Ilford A and C . . .	151—154	79—84	80
65,780	,,	,,	6½	3⅝%	Do. B	115—118	64—69	58
65,500	,,	June 25	4	4%	Do. 4 p.c. Deb. . .	92—94	55—58	...
4,940,000	,,	May 14	9	4½%	Imperial Continental .	150—160	133—138	134½—140
1,235,000	,,	Aug. 12	3½	3⅛%	Do. 3½ p.c. Deb. Red.	84—86	91—95	92—94½
235,242	,,	Sept. 15	6½	5%	Lea Bridge Ord. 5 p.c. .	119—121	80—85	...
2,498,905	,,	Feb. 26	10	37/6	Liverpool 5 p.c. Ord. { A. / B.	211—213 / 146—148	...	...
306,083	,,	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	...	...	...
165,736	,,	Aug. 12	7/5/6	3⅛%	Maidstone 5 p.c. . .	...	52—57	...
75,000	5	June 11	6	3%	Malta & Mediterranean	4¼—4⅝	1½—2½	...
250,000	100	Oct. 1	4½	4½%	Met. of Melbourne 4½ p.c. Deb.	99—101	86—93	...
541,920	Stk.	Nov. 26	4	6%	Monte Video, Ltd. . .	11½—12	68—73*	...
1,875,892	,,	July 29	4½	3⅛%	Newcastle & Gatsh'd Con.	98½—99½	60—61	...
529,705	,,	June 25	3½	3⅛%	Do. 3½ p.c. Deb.	82—83	50—51	...
15,000	10	Sept. 15	—	8%	North Middlesex 10 p.c.	...	12½—13½	...
55,940	10	,,	7/14/0	53⅛%	,, ,, 7 p.c.	14—15	7—7½	...
300,000	Stk.	Nov. 26	8	8%	Oriental, Ltd. . . .	117—122	96—99*	98
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd. . . .	7¼—7⅝	2—3	...
60,000	50	Aug. 27	13	7½%	Portsea Island, B . .	128—131	65—70	...
100,000	50	,,	12	6½%	Do. C . .	118—121	50—55	...
249,980	5	April 29	8	—	Primitiva Ord. . . .	5½—6	⅛—⅜	...
499,960	5	June 26	5	—	Do. 5 p.c. Pref. .	4¼—5	¼—1⅛	20/—21/-
521,600	100	June 1	4	4%	Do. 4 p.c. Deb. .	91—93	69—71	...
600,000	Stk.	July 29	4	4%	Do. ,, ,, 1911	...	40—42	...
346,198	,,	June 25	4	4%	River Plate { 6 p.c. Pref. / 5 p.c. Deb.	85—87	38—43	...
150,000	10	Sept. 30	6	6/-		10¼—11	6¼—7½	...
125,000	50	July 2	5	5%		47—49	38—40	..
135,000	Stk.	Aug. 27	10	5%	Sheffield A	223—224	61—65	..
209,984	,,	,,	10	4%	Do. B	222—224	59—61	..
523,500	,,	,,	10	3½%	Do. C	220—222	59—61	59½
133,201	Stk.	Sept. 15	4	4%	Shrewsbury 5 p.c. . .	...	...	..
90,000	10	Sept. 30	9	9%	South African . . .	10¼—11¼	10¼—11¼	...
6,609,895	Stk.	Aug. 12	5/4/0	30/-	South Met. Ord. . . .	111—113	56—59	57¼—61
250,000	,,	July 14	—	5%	Do. Red. Pref. .	...	91—93	...
1,895,445	,,	,,	3	3%	Do. 3 p.c. Deb..	72½—74½	45—48	...
224,820	,,	Aug. 27	8½	3%	South Shields Con. Stk.	157—159	95—96	...
1,087,795	,,	July 29	6	3½%	S'th Suburb'n Ord. 5 p.c.	114—116	56—61	59
247,558	,,	June 25	5	5%	Do. 5 p.c. Deb. Stk.	116—118	65—70	...
647,740	,,	Nov. 12	7½	3½%	Southampton Ord. . .	99—102	55—58	...
121,275	,,	June 25	4	4%	Do. 4 p.c. Deb. Stk.	...	59—61	...
120,000	,,	Aug. 12	—	3½%	Tottenham District { A 5 p.c. . / B 3½ p.c. . / 4 p.c. Deb.	135—138	60—65	...
782,275	,,	,,	6	2½%		115—117	50—55	51—52½
181,255	,,	June 10	4	4%		87—89	57—60	...
182,380	10	Dec. 30	5	—	Tuscan, Ltd. . . .	5—6	1—2	...
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	45—50	...
236,476	Stk.	Sept. 15	5	3½%	Tynemouth 5 p.c. max.	108½—109	69—71	...
30,000	,,	Aug. 27	8½	47/6	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	151—156	75—80	...
255,636	,,	,,	6½	32/6	Do. B 3½ p.c.	129—134	53—58	...
108,075	,,	,,	—	33/3	Do. C . . .	....	50—55	...
140,865	,,	,,	—	33/3	New Ordinary . . .	...	50—55	...
352,000	,,	,,	6½	26/3	Wimbledon 5 p.c. . .	117—122	43—48	...
98,000	,,	,,	6½	32/6	Epsom 5 p.c. . . .	121—126	50—55	...
88,416	,,	June 25	3	3%	3 p.c. Deb. Stk. . .	66—69	44—47	...

* Ex Div.

London Warming Company.—With a capital of £50,000 in £1 shares, a company has been registered to take over the business of the London Warming and Ventilating Company, Ltd., manufacturers and suppliers of stoves of different types.

A Faulty Gas-Bracket at Walsall.—Last Friday, two assistants at the Brown Lion Hotel, Pleck, Walsall, were found unconscious, owing to an escape of gas in their bedroom. This was due to a faulty bracket, the discovery being made by the landlord. On first aid being administered, the sufferers soon recovered.

Satisfactory Gas Accounts at Darlington.—Under the management of Mr. Frank P. Tarratt, the Darlington Corporation gas undertaking enjoyed a successful twelve months to March 31 last; the accounts recently issued showing a net profit for the year amounting to £4908. There is at the credit of the reserve account £24,276; and the amount of loans outstanding is no more than £86,537—for a works having an output of 515 million c.ft. per annum. The present price of gas is 2s. 9d. per 1000 c.ft to ordinary consumers, and 3s. 7d. to consumers with slot-meters, which is an increase of only 9d. per 1000 c.ft. over pre-war prices.

The Zoning and Grading Scheme.—The "Nottingham Guardian" says that the delay in the zoning and grading of the gas industry in the various areas in the country has created much dissatisfaction among the employees; and at the meeting of the Midland District Council of the National Union of General Workers, the question was freely discussed. From a report submitted, it would appear that there are prospects of trouble arising in the industry. The report showed the progress that had been made by the Midland Regional Gas Council concerning the question of zoning and grading. Dissatisfaction was expressed by representatives of the gas-workers at the apparent delay in the matter; it being pointed out that not one area had yet arrived at a settlement, though the question had been under consideration for about six months. Requests were made that "unless a speedy settlement is brought about, the central authority of the Union should be asked to consider the question of adopting sterner methods."

There was a serious fire last Thursday night in the large export warehouse of the Carron Company in Upper Thames Street.

A statement appeared in the London press last Saturday to the effect that the price of coke, delivered to consumers, had been reduced by 1s. 8d. per ton. The current price for ordinary coke will be 54s. 2d. per ton, and broken coke 1s. 8d. per ton extra.

William H. Treend, a musician, of Hove, committed suicide by placing his head in a gas-oven. There was a handkerchief over his face; and the gas-tap was turned full on. At New Brighton, a verdict of "Murder and suicide" was returned in the case of Henry Rigby, who was found dead with his son in a bedroom filled with gas from an open pipe.

A party of Armstrong College students lately visited the Elswick works of the Newcastle and Gateshead Gas Company, over which they were conducted by members of the staff. The manufacturing operations were fully explained to them; and at the close of the visit a hearty vote of thanks was passed to Mr. T. Hardie (the Chief Engineer) and the guides.

At an inquest, at Norwood Green, near Halifax, a verdict of "Suicide by gas poisoning" was returned in the case of Mary Brooke (41), a single woman, who had been found dead at Copley Mill House, with her head near a gas-cooker and all the taps turned on. The house was nearly full of gas; and it is surprising her employer did not suffer injury on going into the room with a lighted taper.

There having been complaints as to the quality of the gas supplied by the Dundee Corporation, Mr. Alexander Yuill (the Engineer and Manager) explained that the reason was that during the miners' strike they had used coal from stock, and it was of such a quality that great difficulty was experienced in maintaining the supply.

In a circular issued to members, the Chemical and Dyestuff Traders' Association state that information has been received from the Board of Trade that, as regards exports of chemicals and dyestuffs, on the whole licenses are being granted rather more freely at present owing to the falling-off in the home demand; and that the only items which are strictly prohibited are certain essential raw materials, such as benzole, toluol, anthracene, &c., and a few special dyestuffs. Naphthalene is being allowed, provided the applicants can show that supplies are obtainable.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON TUESDAY, to ensure insertion in the following day's issue.

Orders to Alter or Stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Monday.

UNDISPLAYED ADVERTISEMENTS: Situations Wanted, Six Lines and under (about 36 words) 3s.; each additional Line, 6d. Situations Vacant, Apparatus Wanted and for Sale, Contracts, Public Notices, &c., 9d. per Line—minimum, 4s. 6d.

TERMS OF SUBSCRIPTION to "JOURNAL" in the NEW YEAR.

		ONE YEAR.	HALF-YEAR.	QUARTER.
United Kingdom	Advance Rate:	35/-	18/-	10/-
	Credit Rate:	40/-	21/-	11/6
Abroad (in the Postal Union) Payable in Advance		40/-	22/6	12/6

In payment of subscriptions for "JOURNALS" sent abroad, Post Office Orders or Bankers' Drafts on London only are accepted.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C. 4.

Telegrams: "GASKING, FLEET LONDON." Telephone: Holborn 6857.

OXIDE OF IRON
FOR SALE OUTRIGHT, OR ON LOAN.

SPENT OXIDE
PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO. LTD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C. 2.

"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for Gas-Works.
ANDREW STEPHENSON, Gresham House, Old Broad Street, LONDON, E.C. "Volcanism, London."

MEWBURN, ELLIS, & CO.,
CHARTERED PATENT AGENTS AND TRADE MARK AGENTS,
70 & 72, Chancery Lane, London, W.C. 2.
Telegrams: "Patent, London." Phone 243 Holborn.
And 8, St. Nicholas Buildings, Newcastle-on-Tyne.

SPENCER'S Patent Inclined HURDLE GRIDS.
THE very best Patent Grids for Holding Oxide Lightly.
See Illustrated Advertisement, Nov. 10, p. 855.

J. E. C. LORD, Ship Canal Tar Works, Weaste, Manchester. Pitch, Creosote, Benzols, Toluol, Naphtha, Pyridine, all kinds of Cresylic Acid, Carbolic Acid, Sulphate of Ammonia, &c.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, LONDON, S.E. 1.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 815 Oldham, and 2412 Hop, London.
Telegrams—
"BRADDOCK, OLDHAM," and "METRIQUE, LAMB, LONDON."

SULPHATE OF AMMONIA
SATURATORS and all LEAD and TIMBER WORK in connection with Sulphate Plants.
We Guarantee promptness with efficiency for Repairs.
JOSEPH TAYLOR AND CO., CHEMICAL PLANT ENGINEERS, BOLTON, LANCS.
Telegrams—"SATURATORS, BOLTON," Telephone 0848.

BRITISH GAS PURIFYING MATERIAL.
ENGLISH BOG ORE AND NATURAL HYDRATED OXIDE OF IRON.
SPENT OXIDE BOUGHT.
BRITISH GAS PURIFYING MATERIALS CO., LTD.
(W. T. P. CUNNINGHAM, Proprietor.)
18, ARCADIAN GARDENS, WOOD GREEN, LONDON, N. 22.
Telegrams: "Bripurimat, Wood, London."
'Phone: Palmers Green 608.

OXIDE OF IRON.
SPENT OXIDE BOUGHT.
BALE & CHURCH, LTD.
33, ST. MARY AT HILL, LONDON, E.C. 3.
Phone: Avenue 6680.

"TORTO" FIRE CEMENT.
BALE & CHURCH, LTD.
33, ST. MARY AT HILL, LONDON, E.C. 3
Phone: Avenue 6680.

"KLEENOFF," THE COOKER CLEANSER.
Tins for Sale to Consumers.
In Bulk for Works Use.
BALE & CHURCH, LTD.
33, ST. MARY AT HILL, LONDON, E.C.
Phone: Avenue 6680.

GEORGE WILSON GAS METERS, Ltd. for GAS-METERS, ORDINARIES, SLOTS, AND REPAIRS,
Foleshill Road, COVENTRY.
Telephone: 596. Telegrams: "GASMETER,"
and at 7/9, Grosvenor Street, CONDUIT, MANCHESTER.
Telephone: 3214 CITY. Telegrams: "GASMETER."
and 46 & 47, Auckland Street, LONDON, S.E. 11.

INVENTIONS PATENTED. TRADE MARKS REGISTERED.
Advice and Handbook free. 35 years' references. Gas Patents a Speciality. KING'S PATENT AGENCY, Ltd. (Director, B. T. King, A.I.M.E., British and U.S. Regd. Patent Agent), 146A, QUEEN VICTORIA STREET, LONDON, E.C. 4.